US Army Corps
of Engineers
Louisville District

Solicitation For

DISCOM BARRACKS COMPLEX
PHASE I AND IIA
FORT CAMPBELL, KENTUCKY

PN33901 / PN47408
FY 99

15 DECEMBER 98

RFP # DACA27-99-R-0004

SPECIFICATIONS
LIST OF CONTRIBUTORS

DISCOM BARRACKS COMPLEX PHASE 1
PN 33901, FT. CAMPBELL, KENTUCKY

_____Scott Carrithers	Project Architect
_____Doug Pohl	Architectural Checker
_____Tina Beavin	Electrical Engineer
_____Rachael Chapman	Electrical Checker
_____Rose Scharrer	Mechanical Engineer
_____Kerry Prather	Mechanical Checker
_____Jim McCoy	Structural Engineer
_____Tim Wessel	Structural Checker
_____Cliff Jones	Civil Engineer
_____Mike King	Civil Checker
_____Mary Alice McKean	Interior Designer
_____Rachel Meyer	Interior Checker

c:\temp\FTCAMPBELL.pdf

cover.pdf FT. CAMPBELL DISCOM BARRACKS COMPLEX PHASE I AND II

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OMB APPROVAL NO. 2700-0042

SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair)	1. SOLICITATION NO.	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE OF PAGES
	DACA27-99-R-0004	☐ SEALED BID (SFB) ☒ NEGOTIATED	15 Dec 1998	1 of 5

IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO.	6. PROJECT NO.

7. ISSUED BY CODE	8. ADDRESS OFFER TO
U.S. Army Engineer District, Louisville Corps of Engineers 600 Dr. Martin Luther King, Jr. Place Louisville, Kentucky 40202-2230	U.S. Army Engineer District, Louisville Corps of Engineers 600 Dr. Martin Luther King, Jr. Place, Room 821 Louisville, Kentucky 40202-2230

9. FOR INFORMATION CALL:	A. NAME	B. TELEPHONE NO. *(Include area code)* ***(NO COLLECT CALLS)***
	See Instructions	See Instruction

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder."

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS *(Title, identifying no., date):*

DISCOM BARRACKS COMPLEX PHASE I/IIA, FT. CAMPBELL, KENTUCKY

This solicitation is a Request For Proposal (RFP) – The proposal will be evaluated on the following criteria: 1-5

The estimated cost range of this project is from $$25,000,000 to $100,000,000.

BID MODIFICATIONS RECEIVED BY FACSIMILE OR TELETYPE WILL NOT BE CONSIDERED.

AWARD IS BEING MADE PURSUANT TO THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM.

DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS (SEP 1990) FAR 52.211-14: This is a rated order certified for national defense use, and the Contractor shall follow all the requirements of the Defense Priorities and Allocations System regulation (15 CFR 700), PRIORITY RATING: DO-C2

11. The Contractor shall begin performance within _10_ calendar days and complete it within _**_ calendar days after receiving ☐ award, ☒ notice to proceed. This performance period is ☒ mandatory, ☐ negotiable.*(See **Section 00800, Para 1.)*

12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS?	12B. CALENDAR DAYS
☒ YES ☐ NO	10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and _2__ copies to perform the work required are due at the place specified in Item 8 by 4:30 PM local time 26 January 1999. If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee is, ☒ is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

D. Offers providing less than __60___ calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

OFFER *(Must be fully completed by offeror)*

14. NAME AND ADDRESS OF OFFEROR *(Include ZIP Code)*	15. TELEPHONE NO. *(Include area code)*
DUNS #	16. REMITTANCE ADDRESS *(Include only if different than Item 14)* TIN #
CODE FACILITY CODE	

17. The offeror agrees to perform the work at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government within __60___ calendar days after the date offers are due. *(Insert any number equal to or greater than the minimum requirement stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.*

AMOUNTS	Bidders shall show his prices on the Bid Schedule of this section.

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS

The offeror acknowledges receipt of amendments to the solicitation -- give number and date of each

AMENDMENT NO.										
DATE										

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER *(Type or print)*	20B. SIGNATURE	20C. OFFER DATE

AWARD *(To be completed by Government)*

21. ITEMS ACCEPTED:

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA	
24. SUBMIT INVOICES TO ADDRESS SHOWN IN *(4 copies unless otherwise specified) Will be identified in Delegation letters.*	ITEM: Sec 00115 Para. 30	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO ☐ 10 U.S.C. 2304(c)( ) ☐ 41 U.S.C. 253(c)( )
26. ADMINISTERED BY CODE U.S. Army Engineer District, Louisville Corps of Engineers, P.O. Box 59 Louisville, KY 40201-0059		27. PAYMENT WILL BE MADE BY USACE Finance Ctr. (UFC) 5700 Integrity Drive EFT:T Millington, TN 38054-5005

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT *(Contractor is required to sign this document and return ____ copies to issuing office.)* Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration slated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications or incorporated by reference in or attached to this contract.		☐ 29. AWARD *(Contractor is not required to sign this document.)* Your offer on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.	
30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN *(Type or print)*		31A. NAME OF CONTRACTING OFFICER *(Type or print)*	
30B. SIGNATURE	30C. DATE	31B. UNITED STATES OF AMERICA BY	31C. AWARD DATE

ALL BIDDERS READ THE FOLLOWING INSTRUCTIONS

1. Each bidder shall, upon request of the Contracting Officer, furnish a list of the plant available to the bidder and proposed for use of the work.

2. Bidders are cautioned that drawings may not be reproduced to exact scale. All drawings, whether full size or reduced, should be checked for potential discrepancies, dimensions and scales should be verified and all drawings compared.

3. Bidders are required to acknowledge receipt of all amendments to this solicitation on Standard Form 1442 in the space provided, by completing Blocks 8 and 15 of the Amendment Form (SF 30), by separate letter, or by telegram prior to opening of bids. Failure to acknowledge all amendments may cause rejection of the bid/proposal.

NOTE: The Louisville District Office does not have it's own teletype. The bidder must insure that acknowledgment of any of any amendments by telegram will be physically delivered (telephone delivery is not acceptable) and received by the Government prior to the time set for opening of bids.

NEITHER FACSIMILE NOR TELEGRAPHIC BIDS ARE AUTHORIZED!!

CAUTION TO BIDDERS

BEFORE SIGNING AND MAILING THIS BID, PLEASE TAKE NOTE OF THE FOLLOWING, AS FAILURE TO PERFORM ANY ONE OF THESE ACTIONS MAY CAUSE YOUR BID TO BE REJECTED.

1. **AMENDMENTS**. Have you acknowledge receipt of ALL amendments? If in doubt as to the number of amendments issued, please contact our office.

2. **AMENDED BID PAGES**. If any of the amendments furnished amended bid pages, the amended bid pages must be used for preparation of your bid.

3. **LATE BIDS**. Please refer to the Instructions section contained in this package.

4. **BID GUARANTEE**. If bid guarantee is required for this project, sufficient bid guarantee in proper form must be furnished with your bid for construction projects exceeding $100,000.

5. **MISTAKE IN BID**. Have you reviewed your bid prices for possible errors in calculations or work left out?

6. **FAX MODIFICATIONS OF BIDS**. We do not permit modifications of bids by fax.

BID SCHEDULE

CONTINUATION SHEET	REFERENCE NO. DOCUMENT BEING CONTINUED 5 of 5	PAGE

NAME OF OFFEROR OR CONTRACTOR

FAR 52.219-22 Small Disadvantaged Business Status (OCT 1998) ALTERNATE I (OCT 1998)

(a) **General.** This provision is used to assess an offeror's small disadvantaged business status for the purpose of obtaining a benefit on this solicitation. Status as a small business and status as a small disadvantaged business for general statistical purposes is covered by the provision at FAR 52.219-1, Small Business Program Representation.

(b) **Representations.**

(1) General. The offeror represents, as part of its offer, that it is a small business under the size standard applicable to this acquisition; and either-

___(i) It has received certification by the Small Business Administration as a small disadvantaged business concern consistent with 13 CFR 124, Subpart B; and

(A) No material change in disadvantaged ownership and control has occurred since its certification;

(B) Where the concern is owned by one or more disadvantaged individuals, the net worth of each individual upon whom the certification is based does not exceed $750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); and

(C) It is listed, on the date of this representation, on the register of small disadvantaged business concerns maintained by the Small Business Administration; or

___(ii) It has submitted a completed application to the Small Business Administration or a Private Certifier to be certified as a small disadvantaged business concern in accordance with 13 CFR 124, Subpart B, and a decision on that application is pending, and that no material change in disadvantaged ownership and control has occurred since its application was submitted.

(2) __ For Joint Ventures. The offeror represents, as part of its offer, that it is a joint venture that complies with the requirements at 13 CFR 124.1002(f) and that the representation in paragraph (b)(1) of this provision is accurate for the small disadvantaged business concern that is participating in the joint venture. [The offeror shall enter the name of the small disadvantaged business concern that is participating in the joint venture: _____.]

(3) Address. The offeror represents that its address __ is, __ is not in a region for which a small disadvantaged business procurement mechanism is authorized and its address has not changed since its certification as a small disadvantaged business concern or submission of its application for certification. The list of authorized small disadvantaged business procurement mechanisms and regions is posted at http://www.arnet.gov/References/adbadjustments.htm. The offeror shall use the list in effect on the date of this solicitation. "Address," as used in this provision, means the address of the offeror as listed on the Small Business Administrations register of small disadvantaged business concerns or the address on the completed application that the concern has submitted to the Small Business Administration or a Private Certifier in accordance with 13 CFR part 124, subpart B. For joint ventures, "address" refers to the address of the small disadvantaged business concern that is participating in the joint venture.

(c) Penalties and Remedies. Anyone who misrepresents any aspects of the disadvantaged status of a concern for the purposes of securing a contract or subcontract shall:

(1) Be punished by imposition of a fine, imprisonment, or both;
(2) Be subject to administrative remedies, including suspension and debarment; and
(3) Be ineligible for participation in programs conducted under the authority of the Small Business Act.

(End of provision)

FAR 52.219-23 Notice of Price Evaluation Adjustment for Small Disadvantaged Business Concerns (OCT 1998) (ALTERNATE II) (OCT 1998)

(a**) Definitions.** As used in this clause-

“Small disadvantaged business concern" means an offeror that represents, as part of its offer, that it is a small business under the size standard applicable to this acquisition; and either-

(1) It has received certification by the Small Business Administration as a small disadvantaged business concern consistent with 13 CFR 124, Subpart B; and

(i) No material change in disadvantaged ownership and control has occurred since its certification;
(ii) Where the concern is owned by one or more disadvantaged individuals, the net worth of each individual upon whom the certification is based does not exceed $750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); and
(iii) It is listed, on the date of its representation, on the register of small disadvantaged business concerns maintained by the Small Business Administration;

(2) It has submitted a completed application to the Small Business Administration or a Private Certifier to be certified as a small disadvantaged business concern in accordance with 13 CFR124, Subpart B, and a decision on that application is pending, and that no material change in disadvantaged ownership and control has occurred since its application was submitted. In this case, in order to receive the benefit of a price evaluation adjustment, an offeror must receive certification as a small disadvantaged business concern by the Small Business Administration prior to contract award; or

(3) Is a joint venture as defined in 13 CFR 124.1002(f).

“Historically black college or university" means an institution determined by the Secretary of Education to meet the requirements of 34 CFR 608.2. For the Department of Defense (DoD), the National Aeronautics and Space Administration (NASA), and the Coast Guard, the term also includes any nonprofit research institution that was an integral part of such a college or university before November 14, 1986.

"Minority institution" means an institution of higher education meeting the requirements of Section 1046(3) of the Higher Education Act of 1965 (20 U.S.C. 1135d-5(3)) which, for purposes of this clause, includes a Hispanic-serving institution of higher education as defined in Section 316(b)(1) of the Act (20 U.S.C. 1059c(b)(1)).

“United States" mean the Unites States, its territories and possessions, the Commonwealth of Puerto Rico, the U.S. Trust Territory of the Pacific Islands, and the District of Columbia.

(b) **Evaluation adjustment.**

(1) Offers will be evaluated by adding a factor of 10 percent to the price of all offers, except-

(i) Offers from small disadvantaged business concerns, that have not waived the adjustment, whose address is in a region for which an evaluation adjustment is authorized;
(ii) For DOD, NASA, and Coast Guard acquisitions, otherwise successful offers from historically black colleges or universities or minority institutions;

(iii) Otherwise successful offers of eligible products under the Trade Agreements Act when the dollar threshold for application of the Act is equaled or exceeded (see section 25.402 of the Federal Acquisition Regulation (FAR));

(iv) Otherwise successful offers where application of the factor would be inconsistent with a Memorandum of Understanding or other international agreement with a foreign government; and

(v) For DOD acquisitions, otherwise successful offers of qualifying country end products (see sections 225.000-70 and 252.225-7001 of the Defense FAR Supplement).

(2) The factor shall be applied on a line item basis or to any group of items on which award may be made. Other evaluation factors described in the solicitation shall be applied before application of the factor. The factor may not be applied if using the adjustment would cause the contract award to be made at a price that exceeds the fair market price by more than the factor in paragraph (b)(1) of this clause.

(c) **Waiver of evaluation adjustment.** A small disadvantaged business concern may elect to waive the adjustment, in which case the factor will be added to its offer for evaluation purposes. The agreements in paragraph (d) of this clause do not apply to offers that waive the adjustment.

___ Offeror elects to waive the adjustment.

(d) **Agreements.**

(1) A small disadvantaged business concern, that did not waive the adjustment, agrees that in performance of the contract, in the case of a contract for-

(i) Services, except construction, at least 50 percent of the cost of personnel for contract performance will be spent for employees of the concern;

(ii) Supplies (other than procurement from a nonmanufacturer of such supplies), at least 50 percent of the cost of manufacturing, excluding the cost of materials, will be performed by the concern;

(iii) General construction, at least 15 percent of the cost of the contract, excluding the cost of materials, will be performed by employees of the concern; or

(iv) Construction by special trade contractors, at least 25 percent of the cost of the contract, excluding the cost of materials, will be performed by employees of the concern.

(2) A small disadvantaged business concern submitting an offer in its own name agrees to furnish in performing this contract only end items manufactured or produced by small disadvantaged business concerns in the United States. This paragraph does not apply in connection with construction or service contracts.

(End of clause)

SECTION 00110

INSTRUCTIONS FOR NEGOTIATED CONTRACTS

28 March 1998

1. Instructions to Offerors--Competitive Acquisition (OCT 1997)
FAR 52.215-1

(a) Definitions. As used in this provision--
Discussions are negotiations that occur after establishment of the competitive range that may, at the Contracting Officer's discretion, result in the offeror being allowed to revise its proposal. In writing or written means any worded or numbered expression which can be read, reproduced, and later communicated, and includes electronically transmitted and stored information. Proposal modification is a change made to a proposal before the solicitation's closing date and time, or made in response to an amendment, or made to correct a mistake at any time before award. Proposal revision is a change to a proposal made after the solicitation closing date, at the request of or as allowed by a Contracting Officer as the result of negotiations. Time, if stated as a number of days, is calculated using calendar days, unless otherwise specified, and will include Saturdays, Sundays, and legal holidays. However, if the last day falls on a Saturday, Sunday, or legal holiday, then the period shall include the next working day.

(b) Amendments to solicitations. If this solicitation is amended, all terms and conditions that are not amended remain unchanged. Offerors shall acknowledge receipt of any amendment to this solicitation by the date and time specified in the amendment(s).

(c) Submission, modification, revision, and withdrawal of proposals.

(1) Unless other methods (e.g., electronic commerce or facsimile) are permitted in the solicitation, proposals and modifications to proposals shall be submitted in paper media in sealed envelopes or packages

(i) addressed to: U.S. Army Engineer District, Louisville
600 Dr. Martin Luther King, Jr. Place
Room 821, Attn: Linda Hunt-Smith
Louisville, KY 40202-2230

(ii) showing the time and date specified for receipt, the solicitation number, and the name and address of the offeror. Offerors using commercial carriers should ensure that the proposal is marked on the outermost wrapper with the information in paragraphs (c)(1)(i) and (c)(1)(ii) of this provision.

(2) The first page of the proposal must show--

(i) The solicitation number;

(ii) The name, address, and telephone and facsimile numbers of the offeror (and electronic address if available);

(iii) A statement specifying the extent of agreement with all terms, conditions, and provisions included in the solicitation and agreement to furnish any or all items upon which prices are offered at the price set opposite each item;

(iv) Names, titles, and telephone and facsimile numbers (and electronic addresses if available) of persons authorized to negotiate on the offeror's behalf with the Government in connection with this solicitation; and

(v) Name, title, and signature of person authorized to sign the proposal. Proposals signed by an agent shall be accompanied by evidence of that agent's authority, unless that evidence has been previously furnished to the issuing office.

(3) Late proposals and revisions.

(i) Any proposal received at the office designated in the solicitation after the exact time specified for receipt of offers will not be considered unless it is received before award is made and--

(A) It was sent by registered or certified mail not later than the fifth calendar day before the date specified for receipt of offers (e.g., an offer submitted in response to a solicitation requiring receipt of offers by the 20th of the month must have been mailed by the 15th);

(B) It was sent by mail (or telegram or facsimile, if authorized) or hand-carried (including delivery by a commercial carrier) if it is determined by the Government that the late receipt was due primarily to Government mishandling after receipt at the Government installation;

(C) It was sent by U.S. Postal Service Express Mail Next Day Service-Post Office to Addressee, not later than 5:00 p.m. at the place of mailing two working days prior to the date specified for receipt of proposals. The term “working days” excludes weekends and U.S. Federal holidays;

(D) It was transmitted through an electronic commerce method authorized by the solicitation and was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals; or

(E) There is acceptable evidence to establish that it was received at the activity designated for receipt of offers and was under the Government's control prior to the time set for receipt of offers, and the Contracting Officer determines that accepting the late offer would not unduly delay the procurement; or

(F) It is the only proposal received.

(ii) Any modification or revision of a proposal or response to request for information, including any final proposal revision, is subject to the same conditions as in subparagraphs (c)(3)(i)(A) through (c)(3)(i)(E) of this provision.

(iii) The only acceptable evidence to establish the date of mailing of a late proposal or modification or revision sent either by registered or certified mail is the U.S. or Canadian Postal Service postmark both on the envelope or wrapper and on the original receipt from the U.S. or Canadian Postal Service. Both postmarks must show a legible date or the proposal, response to a request for information, or modification or revision shall be processed as if mailed late. “Postmark” means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed by employees of the U.S. or Canadian Postal Service on the date of mailing. Therefore, offerors or respondents should request the postal clerk to place a legible hand cancellation bull's eye postmark on both the receipt and the envelope or wrapper.

(iv) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the proposal wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(v) The only acceptable evidence to establish the date of mailing of a late offer, modification or revision, or withdrawal sent by Express Mail Next Day Service-Post Office to Addressee is the date entered by the post office receiving clerk on the “Express Mail Next Day Service-Post Office to Addressee” label and the postmark on both

the envelope or wrapper and on the original receipt from the U.S. Postal Service. “Postmark” has the same meaning as defined in paragraph (c)(3)(iii) of this provision, excluding postmarks of the Canadian Postal Service. Therefore, offerors or respondents should request the postal clerk to place a legible hand cancellation bull's eye postmark on both the receipt and the envelope or wrapper.

(vi) Notwithstanding paragraph (c)(3)(i) of this provision, a late modification or revision of an otherwise successful proposal that makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

(vii) Proposals may be withdrawn by written notice or telegram (including mailgram) received at any time before award. If the solicitation authorizes facsimile proposals, proposals may be withdrawn via facsimile received at any time before award, subject to the conditions specified in the provision entitled “Facsimile Proposals.” Proposals may be withdrawn in person by an offeror or an authorized representative, if the representative's identity is made known and the representative signs a receipt for the proposal before award.

(viii) If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at the office designated for receipt of proposals by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation or other notice of an extension of the closing date, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office.

(4) Unless otherwise specified in the solicitation, the offeror may propose to provide any item or combination of items.

(5) Proposals submitted in response to this solicitation shall be in English and in U.S. dollars, unless otherwise permitted by the solicitation.

(6) Offerors may submit modifications to their proposals at any time before the solicitation closing date and time, and may submit modifications in response to an amendment, or to correct a mistake at any time before award.

(7) Offerors may submit revised proposals only if requested or allowed by the Contracting Officer.

(8) Proposals may be withdrawn at any time before award. Withdrawals are effective upon receipt of notice by the Contracting Officer.

(d) Offer expiration date. Proposals in response to this solicitation will be valid for the number of days specified on the solicitation cover sheet (unless a different period is proposed by the offeror).

(e) Restriction on disclosure and use of data. Offerors that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall--

(1) Mark the title page with the following legend: This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed--in whole or in part-- for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of--or in connection with-- the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in sheets [insert numbers or other identification of sheets]; and

(2) Mark each sheet of data it wishes to restrict with the following legend: Use or disclosure of data contained

on this sheet is subject to the restriction on the title page of this proposal.

(f) Contract award.

(1) The Government intends to award a contract or contracts resulting from this solicitation to the responsible offeror(s) whose proposal(s) represents the best value after evaluation in accordance with the factors and subfactors in the solicitation.

(2) The Government may reject any or all proposals if such action is in the Government's interest.

(3) The Government may waive informalities and minor irregularities in proposals received.

(4) The Government intends to evaluate proposals and award a contract without discussions with offerors (except clarifications as described in FAR 15.306(a)). Therefore, the offeror's initial proposal should contain the offeror's best terms from a cost or price and technical standpoint. The Government reserves the right to conduct discussions if the Contracting Officer later determines them to be necessary. If the Contracting Officer determines that the number of proposals that would otherwise be in the competitive range exceeds the number at which an efficient competition can be conducted, the Contracting Officer may limit the number of proposals in the competitive range to the greatest number that will permit an efficient competition among the most highly rated proposals.

(5) The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit cost or prices offered, unless the offeror specifies otherwise in the proposal.

(6) The Government reserves the right to make multiple awards if, after considering the additional administrative costs, it is in the Government's best interest to do so.

(7) Exchanges with offerors after receipt of a proposal do not constitute a rejection or counteroffer by the Government.

(8) The Government may determine that a proposal is unacceptable if the prices proposed are materially unbalanced between line items or subline items. Unbalanced pricing exists when, despite an acceptable total evaluated price, the price of one or more contract line items is significantly overstated or understated as indicated by the application of cost or price analysis techniques. A proposal may be rejected if the Contracting Officer determines that the lack of balance poses an unacceptable risk to the Government.

(9) If a cost realism analysis is performed, cost realism may be considered by the source selection authority in evaluating performance or schedule risk.

(10) A written award or acceptance of proposal mailed or otherwise furnished to the successful offeror within the time specified in the proposal shall result in a binding contract without further action by either party.

(11) The Government may disclose the following information in postaward debriefings to other offerors:

(i) The overall evaluated cost or price and technical rating of the successful offeror;

(ii) The overall ranking of all offerors, when any ranking was developed by the agency during source selection;

(iii) A summary of the rationale for award; and

(iv) For acquisitions of commercial items, the make and model of the item to be delivered by the successful

offeror.

28 March 1998
2. PREPARATION OF PROPOSALS--CONSTRUCTION (OCT 1997) FAR 52.236-28

(a) Proposals must be (1) submitted on the forms furnished by the Government or on copies of those forms, and (2) manually signed. The person signing a proposal must initial each erasure or change appearing on any other proposal form.

(b) The proposal form may require Offerors to submit proposals prices for one or more items on various bases, including --

(1) Lump sum price;
(2) Alternate prices;
(3) Units of construction; or
(4) Any combination of paragraphs (b)(1) through (b)(3) of this provision.

(c) If the solicitation requires submission of a proposal on all items, failure to do so may result in the proposal being rejected without further consideration. If a proposal on all items is not required, Offerors should insert the words "no proposal" in the space provided for any item on which no price is submitted.

(d) Alternate proposals will not be considered unless this solicitation authorizes their submission.

3. Not Used

4. PERFORMANCE AND PAYMENT BONDS.

4.1 After the prescribed forms are presented to the offeror to whom award is made for signature, a written contract on the form prescribed by the specifications shall be executed and two bonds, each with good and sufficient surety or sureties acceptable to the Government shall be furnished: a Performance Bond (Standard Form 25) and a Payment Bond (Standard Form 25A). The penal sums of such bonds will be as follows:

(a) Performance Bond. The penal sum of the performance bond shall equal one hundred percent (100%) of the contract price.

(b) Payment Bond.
(1) When the contract price is $1,000,000 or less, the penal sum will be fifty percent (50%) of the contract price.

(2) When the contract price is in excess of $1,000,000 but not more than $5,000,000, the penal sum shall be forty percent (40%) of the contract price.
(3) When the contract price is more than $5,000,000 the penal sum shall be $2,500,000.

4.2 Any bonds furnished will be furnished by the Contractor to the Government prior to commencement of contract performance.

4.3 Rules for Use of Individual Sureties.

(a) One individual surety is adequate support for a bond, provided the unencumbered value of the assets pledged by that individual surety equal or exceed the amount of the bond. An offeror may submit up to three individual sureties for each bond, in which case the pledged assets when combined must equal or exceed the penal amount of the bond. Each individual surety must accept both joint and several liability to the extent of the penal amount of

the bond.

(b) An individual surety may be accepted only if a security interest in acceptable assets is provided to the Government by the individual surety. The security interest shall be furnished with the bond, and may be provided by one or a combination of the following methods:

(1) An escrow account with a federally insured financial institution in the name of the contracting agency.

(2) A lien on real property, subject to restrictions contained herein.

(c) Acceptable assets include:

(1) Cash or certificates of deposit, or other cash equivalents with a federally insured financial institution;

(2) United States Government securities at market value;

(3) Stocks and bonds actively traded on a national U.S. security exchange with certificates issued in the name of the individual surety (these assets will be accepted at 90 percent of their 52-week low, as reflected at the time of submission of the bond)

(4) Real property owned in fee simple by the surety without any form of concurrent ownership (these assets will be accepted at 100 percent of the most current tax assessment value exclusive of encumbrances or 75 percent of the properties' unencumbered market value provided a current appraisal is furnished)

(5) Irrevocable letters of credit (ILC) issued by a federally insured financial institution in the name of the contracting agency and which identify the agency and solicitation or contract number for which the ILC is provided.

(d) Unacceptable assets include but are not limited to:

(1) Notes or accounts receivable;

(2) Foreign securities;

(3) Real property as follows:

a. Real property located outside the United States, its territories, or possessions.

b. Real property which is a principal residence of the surety.

c. Real property owned concurrently regardless of the form of co-tenancy except where all co-tenants agree to act jointly.

d. Life estates, leasehold estates, or future interests in real property.

(4) Personal property such as jewelry, furs, antiques;

(5) Stocks and bonds of the individual surety in a controlled, affiliated, or closely held concern of the Offeror/Contractor;

(6) Corporate assets (e.g., plant and equipment);

(7) Speculative assets (e.g., mineral rights);

(8) Letters of credit, except as provided in subparagraph c(5) above.

(e) With respect to the acceptance of real property, the individual surety shall provide:

(1) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice;

(2) Evidence of the amount due under any encumbrance shown in the evidence of title

(3) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice.

(4) Failure to provide evidence that the lien has been properly recorded will render the offeror nonresponsible.

(f) An individual may be excluded from acting as individual surety on bonds for any of the following causes:

(1) Failure to fulfill the obligations under any bond.

(2) Failure to disclose all bond obligations.

(3) Misrepresentation of the value of available assets or outstanding liabilities.

(4) Any false or misleading statement, signature or representation on a bond or affidavit of individual suretyship.

(5) Any other cause affecting responsibility as a surety of such serious and compelling nature as may be determined to warrant exclusion.

An individual surety excluded pursuant to this subsection shall be included on the list entitled "Parties Excluded from Procurement Programs."

(g) Any bidder or offeror should carefully review these requirements which are set forth in Section 28 of the Federal Acquisition Regulations (FAR).

28 March 1998
5. SITE VISIT (Choice 2)(CONSTRUCTION) FAR 52.236-27 (FEB 1995).

(a) The clauses at 52.236-2, Differing Site conditions, and 52.236-3, Site Investigations and conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed. Site visits may be arranged during normal office hours by contacting:

Ft. Campbell Area Office
Building 2180 13 ½ Street
Ft. Campbell, Kentucky 42223-5356
Telephone 502-798-9662
Fax 502-798-5060

3 June 1998
6. REQUESTS FOR INFORMATION relating to this procurement should be directed to the Louisville District, Corps of Engineers, as follows:

Procurement of Plans & Specifications—Barb Rich.....502/582-5815

Prospective Offerors may find the planholders list on the Internet at http://www.orl/usace.army.mil/ceorl1/ct_pages.htm

Technical Questions on Plans & Specifications—Scott Carrithers.....502/582-5788

31 October 1997
7. AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (JUN 1997) FAR 52.211-1

(a) A single copy of each specification cited in this solicitation is available without charge from the GSA Federal Supply Service Bureau Specifications Section (3FBP-W), 470 East L'Enfant Plaza, SW., Suite 8100, Washington, D.C. 20407 (Tel. 202-619-8925). Additional copies may be purchased from the GSA Specifications Section in Washington, D.C.

(b) The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

31 October 1997
8. AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX OF SPECIFICATIONS AND STANDARDS (DODISS) (JUN 1997) FAR 52.211-2.

Single copies of specifications cited in this solicitation may be obtained by submitting a written request to the supply point listed below. The request must contain the title of the solicitation, its number, date, applicable amendment(s), and the solicitation or contract number. A telephone order entry system is available with the use of a touch tone telephone. A Customer Number is required to use this system and may be obtained in written request to the address listed below or by telephone (215-697-2179). In case of urgency, telegraphic requests are acceptable. Voluntary standards, which are not available to offerors and Contractors from Government sources, may be obtained from the organization responsible for their preparation, maintenance, or publication.

Standardization Documents
Order Desk, Building 4, Section D
700 Robbins Avenue
Philadelphia, PA 19111-5094
Fax Number (215)-697-2978

20 March 1997
9. AVAILABILITY OF SPECIFICATIONS AND STANDARDS NOT LISTED IN DODISS, DATA ITEM DESCRIPTIONS NOT LISTED IN DOD 5010.12-L, AND PLANS, DRAWINGS, AND OTHER PERTINENT DOCUMENTS (DEC 1991) DFARS 252.211-7001

Offerors may obtain the specifications, standards, plans, drawings, data item descriptions, and other pertinent documents cited in this solicitation by submitting a request to:

As stated in Paragraph 6.

Include the number of the solicitation and the title and number of the specification, standard, plan, drawings, or other pertinent document.

10. NOT USED.

2 Jan 1996
11. INDUSTRY SMALL BUSINESS SIZE STANDARDS FAR 19.102.

11.1 General.

(a) The SBA establishes small business size standards on an industry-by-industry basis. These size standards are also set forth in SBA's
regulations at 13 CFR 121.

(b) Small business size standards are applied by--

(1) Classifying the product or service being acquired in the industry whose definition, as found in the Standard Industrial Classification (SIC) Manual, best describes the principal nature of the product or service being acquired.

(2) Identifying the size standard SBA established for that industry; and

(3) Specifying the size standard in the solicitation, so that offerors can appropriately represent themselves as small or large.

(c) For size standard purposes, a product or service shall be classified in only one industry, whose definition best describes the principal nature of the product or service being acquired even though for other purposes it could be classified in more than one.

(d) When acquiring a product or service that could be classified in two or more industries with different size standards, contracting officers shall apply the size standard for the industry accounting for the greatest percentage of the contract price.

(e) If a solicitation calls for more than one item and allows offers to be submitted on any or all of the items, an offeror must meet the size standard for each item it offers to furnish. If a solicitation calling for more than one item requires offers on all or none of the items, an offeror may qualify as a small business by meeting the size standard for the item accounting for the greatest percentage of the total contract price.

(f) Any concern which submits a bid or offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is deemed to be a small business when--

(1) In the case of Government acquisitions set-aside for small businesses, such nonmanufacturer must furnish in the performance of the contract the product of a small business manufacturer or producer, which end product must be manufactured or produced in the United States. The term "nonmanufacturer" includes a concern which can manufacture or produce the product referred to in the specific acquisition but does not do so in connection with that acquisition. For size determination purposes there can be only one manufacturer of the end item being procured. The manufacturer of the end item being acquired is the concern which, with its own forces, transforms inorganic or organic substances including raw materials and/or miscellaneous parts or components into such end item. Whether an offeror on a particular acquisition is the manufacturer or a nonmanufacturer for the purpose of a size determination need not be consistent with whether such concern is or is not a manufacturer for the purpose of the Walsh-Healey Act.

(2) A concern which purchases items and packages them into a kit is considered to be a nonmanufacturer small business and can qualify as such for a given acquisition if it meets the size qualifications of a small nonmanufacturer for the acquisition, and if more than 50 percent of the total value of the kit and its contents is accounted for by items manufactured by small business.

(3) If the acquisition is subject to and is actually procured under "small purchase procedures", such nonmanufacturer may furnish any domestically produced or manufactured product.

(4) For the purpose of receiving a Certificate of Competency on an unrestricted acquisition, a small business nonmanufacturer may furnish any domestically produced or manufactured product. The applicable size standard shall be that of the wholesale industry of the item being acquired.

11.2 The industry size standards are set forth in the following table. The table column labeled "SIC" follows the standard industrial classification code as published by the Government in the Standard Industrial Classification Manual. The Manual is intended to cover the entire field of economic activities. It classifies and defines activities by industry categories and is the source used by SBA as a guide in defining industries for size standards. The number of employees or annual receipts indicates the maximum allowed for a concern, including its affiliates, to be considered small.

11.3 Size standards for construction and special trades.
A concern is small if its average annual receipts for its preceding 3 fiscal years did not exceed $17 million. However, if 75 percent or more of the work (in terms of dollar value) called for by the contract is classified in one of the industries, subindustries, or classes of products listed in this paragraph, the concern is small if its average annual receipts for its preceding 3 fiscal years did not exceed the size standard for that industry, subindustry, or class of products. (See Division C, "Contract Construction," of the SIC Manual).

Classification Code	Industry, Subindustry, or Class of Products	Size Standard*
	MAJOR GROUP 15--BUILDING CONSTRUCTION--GENERAL CONTRACTORS AND OPERATIVE BUILDERS	
1521	General Contractors--Single-Family House	$17.0
1522	General Contractors--Residential Buildings, Other Than Single-Family	17.0
1531	Operative Builders	17.0
1541	General Contractors--Industrial Buildings and Warehouses	17.0
1542	General Contractors--Nonresidential Buildings Other Than Industrial Buildings and Warehouse	17.0
	MAJOR GROUP 16--CONSTRUCTION OTHER THAN BUILDING CONSTRUCTION--GENERAL CONTRACTORS	
1611	Highway and Street Construction, Except Elevated Highway	17.0
1622	Bridge, Tunnel, and Elevated Highway Construction	17.0
1623	Water, Sewer, Pipe Line, Communication and Power Line Construction	17.0
1629	Heavy Construction, Except Dredging N.E.C.	17.0
1629	Dredging and Surface Cleanup Activities	13.5

MAJOR GROUP 17--CONSTRUCTION--SPECIAL TRADE CONTRACTORS

1711	Plumbing, heating (except electric), and air conditioning	7
1721	Painting, paperhanging, and decorating	7
1731	Electrical Work	7
1741	Masonry, stone setting, and other stonework	7
1742	Plastering, drywall, acoustical and insulation work	7
1743	Terrazzo, tile, marble, and mosaic work	7
1751	Carpentering and flooring	7
1752	Floor laying and other floorwork, not elsewhere classified	7
1761	Roofing and sheet metal work	7
1771	Concrete work	7
1781	Water well drilling	7
1791	Structural steel erection	7
1793	Glass and glazing work	7
1794	Excavating and foundation work	7
1795	Wrecking and demolition work	7
1796	Installation or erection of building equipment, not elsewhere classified	7
1799	Special trade contractors, not elsewhere classified	7

* (Average Annual Receipts) (Millions)

12. CONTRACT PRICES - BIDDING SCHEDULES (DEC 1991) DFARS 52.236-7008.

(a) The Government's payment for the items listed in the Bidding Schedule shall constitute full compensation to the Contractor for--

(1) Furnishing all plant, labor, equipment, appliances, and materials; and

(2) Performing all operations required to complete the work in conformity with the drawings and specifications.

(b) The Contractor shall include in the prices for the items in the Bidding Schedule all costs for work in the specifications, whether or not specifically listed in the Bidding Schedule.

2 Jan 96
13. ARITHMETIC DISCREPANCIES EFARS 52.214-5000.

(a) For the purpose of initial evaluation of bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the bidding schedule as submitted by the offeror:

(1) Obviously misplaced decimal points will be corrected;

(2) In case of discrepancy between unit prices and extended price, the unit price will govern;

(3) Apparent errors in extension of unit prices will be corrected; and

(4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purposes of bid evaluation, the Government will proceed on the assumption that the offeror intends his

offer to be evaluated on the basis of the unit prices, the totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.

(c) These correction procedures shall not be used to resolve any ambiguity concerning which bid is low.

1 February 1995
14. WAGE RATES. The Wage Decisions of the Secretary of Labor are applicable to the work to be performed under this contract and are contained in SECTION 00800, SPECIAL CONTRACT REQUIREMENTS. Modifications are periodically made to the wage decisions. The complete modifications will be issued by amendment to the solicitation.

22 June 1998
15. NOTICE OF BUY AMERICAN ACT REQUIREMENT – CONSTRUCTION MATERIALS. (MAY 1997)

(a) Offerors are required to comply with the requirements of Federal Acquisition Regulation (FAR) clause 52.225-5, Buy American Act – Construction Materials, of this solicitation. The terms “construction material” and “domestic construction material,” as used in this provision, have the meanings set forth in FAR clause 52.225-5.

(b) Offerors should request a determination regarding the inapplicability of the Buy American Act in time to allow determination before submission of offers. For evaluation of a request for a determination regarding the inapplicability of the requirements of the Buy American Act prior to the time set for receipt of offers, the information and applicable supporting data required by paragraphs (c) and (d) of Far clause 52.225-5 shall be included in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act prior to submission of its offer, or has not received a response to a request made prior to submission of its offer, the information and supporting data shall be included in the offer.

(c) Evaluation of offers.

(1) For evaluation of offers, (unless agency regulations specify a higher percentage) the Government will add to the offered price 6 percent of the cost of any foreign construction material proposed for exception from the requirements of the Buy American Act based on claimed unreasonable cost of domestic construction materials in accordance with paragraph (b)(3)(i) of FAR clause 52.225-5.

(2) If the evaluation of offers results in a tie between an offer including such foreign construction material excepted on the basis of unreasonable cost, as evaluated, and an offer including solely domestic construction material or other foreign construction material listed in the solicitation at paragraph (b)(2) of FAR clause 52.225-5, or subsequently excepted in accordance with paragraphs (b)(3)(ii) or (iii) of FAR clause 52.225-5, award shall be made to the offeror that submitted the latter offer.

(d) Alternate offers.

(1) When an offer includes foreign construction material not listed by the Government in the solicitation at paragraph (b)(2) of Far clause 52.225-5, offerors also may submit alternate offers base on use of equivalent domestic construction.

(2) If alternate offers are submitted, a separate Standard Form 142 shall be submitted for each alternate offer, and a separate price comparison table, prepared in accordance with paragraph (c) and (d) of FAR clause 52.225-5, shall be submitted for each offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception to apply.

(3) If the Government determines that a particular exception requested under paragraph (c) of FAR clause 52.225-5 does not apply, the Government will evaluate only those offers based on use of the equivalent

domestic construction material, and the offeror shall be required to furnish such domestic construction material.

(i) In sealed bid procurements, any offer based on use of that particular foreign construction material shall be rejected as nonresponsive.

(ii) In negotiated procurements, any offer based on use of that particular foreign construction material may not be accepted unless revised during negotiations.

16. LISTING OF EMPLOYMENT OPENINGS. Offerors should note that this solicitation includes a provision requiring the listing of employment openings with the local office of the State employment service system if the award is for $10,000 or more.

17. NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (APR 1984) FAR 52.222-23.

(a) The Offeror's attention is called to the EQUAL OPPORTUNITY and the AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION clauses of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation in each trade
18.2%	6.9%

.....

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally assisted) performed in the covered area. If the Contractor performs construction work (whether or not it is Federal or Federally assisted) in a geographical area located outside the covered area, it shall apply the goals established for the geographical area where such work is actually performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs (OFCCP) Office.

(c) The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity clause, specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction" and its efforts to meet prescribed goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Director, OFCC within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor, employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in the contract resulting from this Solicitation, the "covered area" is Clarksville, Tennessee and Hopkinsville, Kentucky economic area which includes Christian County, Kentucky.

28 March 1998
18. SUBCONTRACTING PLANS FOR SMALL, SMALL DISADVANTAGED, AND WOMEN-OWNED SMALL BUSINESS CONCERNS. Offerors are cautioned that compliance with CONTRACT CLAUSE: SMALL, SMALL DISADVANTAGED, AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN requires that the offeror, if a large business, submit a subcontracting plan for subcontracting with small, small disadvantaged, and women-owned small business concerns. Offerors desiring assistance in developing a source list are encouraged to contact small, small disadvantaged, and women-owned small business concerns, associations and appropriate Offices of Small and Disadvantaged Business Utilization, addresses which may be obtained from the District Labor Adviser, U.S. Army Engineer District, P.O. Box 59, Louisville, Kentucky 40201 (Telephone 502/582-5679).

19. PERFORMANCE OF WORK BY CONTRACTOR. Attention is directed to SPECIAL CONTRACT REQUIREMENT: PERFORMANCE OF WORK BY CONTRACTOR. The successful offeror must furnish the Contracting Officer, within 5 days after award, a description of the work which he intends to perform with his own organization, e.g., earthwork, paving, brickwork, or roofing), the percentage of the total work this represents, and the estimated cost thereof.

20. PAYMENT FOR BOND PREMIUMS. CONTRACT CLAUSE: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS provides that upon presentation of evidence of full payment, the Government will immediately reimburse the Contractor the cost of premiums for performance and payment bonds. This reimbursement amount is not in addition to the amount offered for the work covered by this Request for Proposals, and offerors are cautioned to include the cost of such premiums in the offer items shown on the Bidding Schedule (or in the lump sum amount of the offer if no offer items are listed). If bond premiums are reimbursed under this clause, such reimbursed amount will be recovered by the Government from the progress payments made to the Contractor or, if no progress payments are made, from the amount otherwise due the Contractor upon final payment.

21. NOT USED.

22. COMMERCIAL AND GOVERNMENT ENTITY (CAGE) CODE REPORTING (DEC 1991) DFARS 252.204-7001

(a) The Offeror is requested to enter a CAGE code on its offer in the block with its name and address. The CAGE code entered must be for that name and address. Enter CAGE before the number.

(b) If the Offeror does not have a CAGE code, it may ask the Contracting Officer to request one from the Defense Logistics Services Center (DLSC). The
Contracting Officer will--

(1) Ask the Contractor to complete section B of a DD Form 2051, Request for Assignment of a Commercial and Government Entity (CAGE) Code;

(2) Complete section A and forward the form to DLSC; and

(3) Notify the Contractor of its assigned CAGE code.

(c) Do not delay submission of the offer pending receipt of a CAGE code.

23. NOT USED.

28 March 1998
24. SERVICE OF PROTEST (AUG 1996) FAR 52.233-2.

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO) shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from:

Ms. Janet M. Henderzahs, Contracting Officer
U. S. Army Engineer District, Louisville
Corps of Engineers - ATTN: CEORLCT
600 Dr. Martin Luther King, Jr. Place, Room 821
Louisville, KY 40201-0059

(b) The copy of any protest shall be received in the office designated above on the same day a protest is filed with the GSBCA or within one day of filing a protest with the GAO.

20 March 1997
25. DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (APR 1998) FAR 52.204-6

(a) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation "DUNS" followed by the DUNS number that identifies the offeror's name and address exactly as stated in the offer. The DUNS number is a nine-digit number assigned by Dun and Bradstreet Information Services.

(b) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one. A DUNS number will be provided immediately by telephone at no charge to the offeror. For information on obtaining a DUNS number, the offeror, if located within the United States, should call Dun and Bradstreet at 1-800-333-0505. The offeror should be prepared to provide the following information:

(c) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one. A DUNS number will be provided immediately by telephone at no charge to the offeror. For information on obtaining a DUNS number, the offeror should call Dun and Bradstreet at 1-800-333-0505. The offeror should be prepared to provide the following information:

(1) Company name.
(2) Company address.
(3) Company telephone number.
(4) Line of business.
(5) Chief executive officer/key manager.
(6) Date the company was started.
(7) Number of people employed by the company.
(8) Company affiliation.

(d) Offerors located outside the United States may obtain the location and phone number of the local Dun and Bradstreet Information Services office from the Internet Home Page at http://www.dbisna.com/dbis/customer/custlist.htm. If an offeror is unable to locate a local service center, it may send an e-mail to Dun and Bradstreet at globalinfo@dbisma.com.

20 March 1997
26. NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (SEP 1990) FAR 52.211-14.

Any contract awarded as a result of this solicitation will be a [ ] DX rated order; [X] DO-C2 rated order certified for national defense use under the Defense Priorities and Allocations System (DFARS) 15 CFR 700, and the

Contractor will be required to follow all of the requirements of this regulation.

27. PRICE BASIS. Prices must be firm. Offers will not be considered which provide for subsequent increase in price.

28. RESTRICTIVE LIMITATION

(a) Except for Additives and Options, the Government shall accept all items listed in Schedule 00010 of this solicitation.

(b) Offers may not be submitted for quantities less than those specified.

29. AWARD TO SINGLE OFFERS. Subject to the provisions contained herein, award shall be to a single offeror.

22 June 1998
30. SUBMISSION OF INVOICES

In accordance with Section 00010, Para. 24, submit invoices to:

Ft. Campbell Area Office
Bldg. 2180, 13 ½ Street
Ft. Campbell, Kentucky 42223-5356
502-798-7222

31. NOT USED.

20 March 1997
(2) 32. EVALUATION OF OPTIONS (JUL 1990) FAR 52.217-5
Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

33. NOT USED.

27 March 1998

SECTION 00115

PROCEDURES FOR SUBMITTAL OF OFFERS

1. GENERAL REQUIREMENTS.

1.1 The intent of this solicitation is to select one contractor for the construction of the DISCOM Barracks Complex at Fort Campbell, Kentucky.

1.2 Offerors submitting proposals for this project should limit submissions to data essential for evaluation of proposals so that a minimum of time and monies will have been expended in preparing information required herein.

1.1. Where to Submit. Offerors shall submit the below-listed number of proposal packages to the Corps of Engineers at the address shown in Section 00010, Block 8 of Standard Form 1442, Room 821.

1.3. Submission Deadline. Proposals shall be received by the Corps of Engineers no later than the time and date specified in Section 00010, Block 13 of Standard Form 1442. All information requested by Sections I through VI must be submitted for the proposal to be considered competitive.

1.4. Submission Format and Number of Submittals. All proposed materials shall be submitted in binders with a table of contents and tabbed section dividers. The sections should parallel the submission requirements identified below. Sections I, and II, and III should be submitted in original and 4 copies. Sections IV, V, and VI should be submitted in original and two copies and should be placed in a separate envelope.

2. PROPOSAL SECTIONS.

2.1 Section I. Administrative/Management Information

Identification of personnel responsible for management and quality of this project, to include the following:

A. Present a resume for all key personnel including:

a. Project Manager
b. Project Engineers
c. Project Superintendent
d. QC Manager
e. Electrical CQC Specialist
f. Mechanical CQC Specialist
g. Civil CQC specialist
h. Structural CQC Specialist
i. Environmental and Erosion Control CQC Specialist
j. Architectural CQC Specialist
k. Site Safety Manager
l. Electrical Superintendent
m. Mechanical Superintendent
n. Site Grading Superintendent
o. Masonry Superintendent
p. Steel Superintendent
q. Drywall Superintendent
r. Painting Superintendent

s. Metal Siding/Roofing Superintendent, including respective authorities and areas or responsibility.

B. Provide an organizational chart for this project showing home office support, on-site management, and the responsible chain of command. Relationships of Joint Venture if any. Include names of assigned personnel and all subcontractors and their areas or responsibility.

C. Describe Home Office engineering support and procurement support for the project.

D. Provide a list of specific Subcontractors for this project and their respective areas of responsibilities. Include if subcontractors are Small Business, Disadvantaged, or Woman Owned. ***Note: The listed subcontractors must be used on the project!***

E. Present a narrative description of the proposed method of project management along with the level of commitment by senior executives toward successful completion of the project.

F. Provide a labor and equipment plan showing personnel and equipment committed to the job along with estimated numbers of each. Designate if equipment is contractor or subcontractor owned or rental or if equipment will be purchased.

G. Submit a proposed Quality Control Plan in accordance with Section 01451, CONTRACTOR QUALITY CONTROL, including subcontractors and suppliers with over $1,000,000 of work and how test requirements are met. (Note: This plan will be used for evaluation purposes only, and will not replace the requirement in Section 00800 to submit an approved plan after contract award)

H. Present a formal written Safety Program proposed for this project for Prime and Subcontractors including name and resume of firms safety director showing responsibilities and chain of command. The program shall include positive incentive plan with tangible rewards.

2.2 Section II. Past Performance Information

A. Information demonstrating knowledge, skill and experience of prime contractor and subcontractor(s) doing the following work:

(1) Construction and overall management of Barracks and Office/Administration projects over $10 million in cost.

(2) Construction and overall management of Barracks and Office/Administration projects with multiple completion dates.

B. References for three (3) similar projects of comparable scope and complexity within the past ten years (10 yrs) for each item reference above including project name, location, owner's name, telephone number(s) and point of contact, partnering experience, past ratings, and joint venture information if any.

C. Provide projects within the past ten years (10 yrs) for

(1) Electrical
(2) Mechanical
(3) Site Grading
(4) Masonry
(5) Steel
(6) Drywall
(7) Painting

(8) Metal

Roofing and siding subcontractor(s), showing past working relationships between the prime and the proposed subcontractor(s), including joint venture and partnering experience.

D. Provide the following safety information related to safety performance:

(1) Workman's Compensation Experience Modification Insurance Ratings (Insurance company to verify ratings)

(2) Results of all previous OSHA inspections or statement of no inspection in the past five years.

(3) Frequency of Lost Workday Cases due to accidents in last five years compared to Industry Standards.

2.3 Section III. Proposed Schedule

Submit a Summary Network Analysis showing how work will be performed and completed on completion dates shown in Special Contract Requirements No. 1.

2.4 Section IV. Subcontracting Plan

Large Business offerors shall submit a subcontracting plan in accordance with Contract Clauses 52.219-8 and 52.219-9. to be acceptable, plans must adequately address the six required statutory elements and provide sufficient information to enable the Contracting Officer to answer affirmatively questions A through H of Appendix CC, Part 2, AFARS 19.705. You may use the attached sample Subcontracting Plan. Percentage goals for the Louisville District are 61.2% to Small Business, 9.1% to Small Disadvantaged Business and 4.5% to Woman-Owned Small Business.

2.5 Section V. Price Proposal

The Offeror shall submit, in a separate envelope, Standard Form 1442 and Form 336 (Proposed Bid Schedule) in an original only. Both of these forms are included in Section 00010 of this solicitation.

2.6 Section VI. Performance Capabilities

The Offeror shall submit on completed original of Section 00600, Representations and Certifications.

One copy of the following information shall be provided:

(1) Proof of Financial Ability (Most recent financial statement covering assets and liabilities)

(2) Number of years the firm has been in business

(3) Name, address and telephone number of firm's bonding company

(4) Information showing offeror's bondability for this project. Include the bond rate.

(5) Name, address and telephone numbers of two credit/trade reference.

LOCATION OF BID OPENING. Bidders are provided the following information as a service by the government. The government cannot be held liable for street closures, traffic delays or other problems that may be encountered due to reliance upon the government's suggested routes to the Federal Building.

Motorist coming from I-65 North:

Immediately after crossing the kennedy bridge, take exit I-64 West (St. Louis). Once in I-64, take the 9th street exit. Continue straight on 9th street for approximately seven blocks to Broadway (first major street with two-way traffic). Turn left on Broadway; go two blocks and turn left on 7th street (7th street is one-way north bound). Approximately ½ block north on 7th street is a stop light, our building is on the right just past the light. There should be ample parking available either by street-side or garage parking. Upon entering the building proceed to the eighth floor and go to room 821.

Motorist coming from I-65 South:

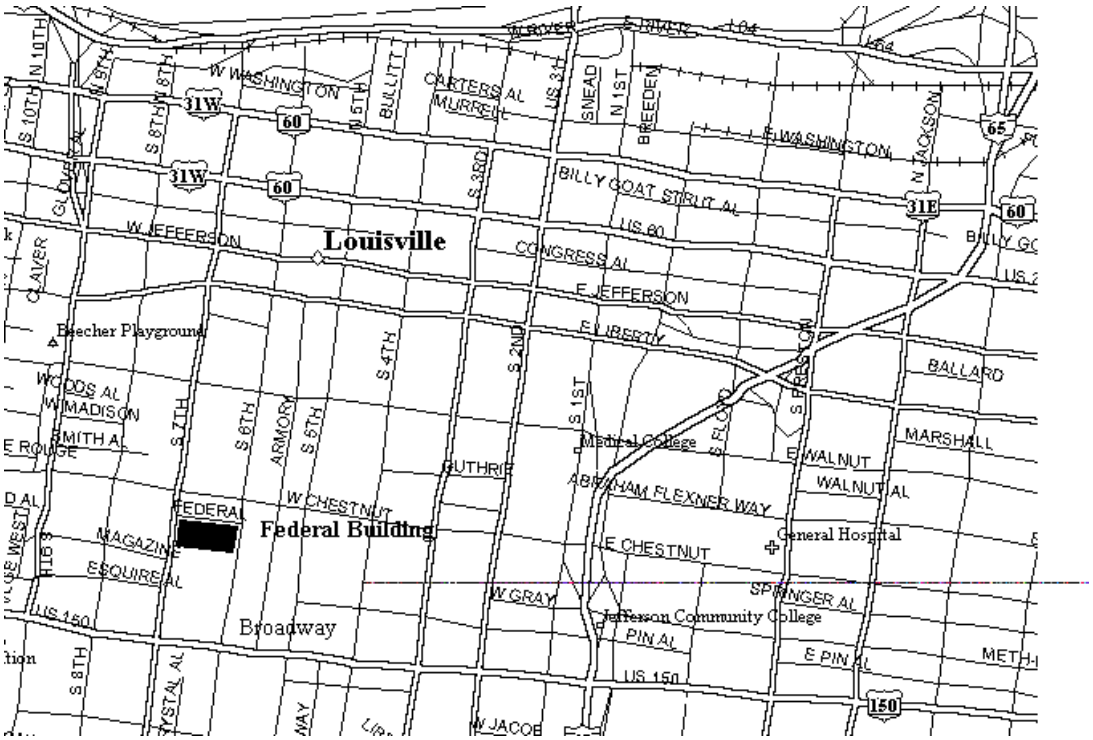
Take Broadway exit and turn left on Broadway (west bound) and continue to 7th street and turn right. Approximately ½ block north on 7th street is a stop light, our building is on the right just past the light. There should be ample parking available either by street-side or garage parking. Upon entering the building proceed to the eighth floor and go to room 821.

Motorist coming from I-64 East and West:

Exit the 9th street exit. At the bottom of the ramp continue south down 9th street for approximately seven blocks until you come to Broadway (first major two way street). Turn left on Broadway and to two blocks and turn left on 7th street (7th street is one-way north bound). Approximately ½ block north on 7th street is a stop light, our building is on the right just past the light. There should be ample parking available either by street-side or garage parking. Upon entering the building proceed to the eighth floor and go to room 821.

Motorist coming from I-71:

Follow routing for intersecting with I-64 and follow the instructions for I-64 motorists.



27 March 1998

SECTION 00130

PROPOSAL EVALUATION SYSTEM

1. STATEMENT OF WORK. The contractor shall construct the DISCOM Barracks, Phase I, Ft. Campbell, Kentucky in accordance with the provisions set forth in the Request for Proposal (RFP) and in the contractor's proposal thereto.

2. GENERAL.

2.1. Proposal Evaluation. An evaluation team will be established to evaluate each proposal in response to this RFP. The technical and non-technical aspects of each proposal will be evaluated.

2.2. Competitive Range. Each proposal shall be reviewed to establish a competitive range to this RFP.

2.3. Design Freedom. **This REQUEST FOR PROPOSAL is not a design/build. The design is 100% complete. Proposed design changes and other cost saving proposals <u>are not solicited</u> and <u>will not be reviewed during evaluation of proposals.</u>**

20 March 1997
3. PROPOSAL EVALUATION CRITERIA. Proposals will be evaluated in accordance with the following criteria, listed in relative order of importance.

a. Administration/Management Information
b. Past Performance Information
c. Proposed Schedule
d. Subcontracting Plan
e. Price Proposal
f. Performance Capabilities

3.1. Description of Proposal Evaluation Criteria. Proposals will be technically reviewed by qualified evaluators to initially determine basic conformance with the RFP, e.g., minimum acceptable compliance with applicable codes, standards and specifications. Further evaluation will establish a relative order of merit among proposals in accordance with the following:

a. Administration/Management Information. The Offeror must be able to demonstrate sound management practices – both at the home office as well as the project site. In accordance with Section 00115, the Offeror must clearly identify the personnel that will be responsible for the management and quality of this project. The Offeror shall also identify his subcontractor plan or labor and equipment plan (if using his own forces) to assure that he has the required manpower in order to perform the work. The Offeror's personnel will be evaluated on their related individual past experience and any other specific requirements of the RFP. The organization chart will be evaluated based on the flow of authority and the ability of the on-site team to manage the project. The level of management interest and proposed method of project management will also be evaluated. The quality control plan will be evaluated on how well it meets the requirements of the RFP.

b. Past Performance Information.

(1) Evaluation and verification of data submitted with respect to past performance will assist the Contracting Officer in making the determination as to the Offeror's responsibility. Any prospective Contractor must be found to be responsible in order to be considered for contract award. The Offeror will be evaluated based on all of the experience required by Section 001150. Missing experience will cause the Offeror to be rated lower.

(2) Documentation of successful completion of projects similar in nature and scope and complexity to the proposed project will be favorably considered during the evaluation. Favorable consideration will also be given to Offers that show successful past relationships by the prime contractor with subcontractors proposed for this project. Conversely, offers which do not include substantial evidence, satisfactory to the contracting Officer, that the Offeror has experience, and production capacity to successfully prosecute the proposed project will not be favorably considered.

(3) The Contracting Officer may solicit and consider information from prior and current clients of offerors. Negative and positive information with respect to quality of construction, timeliness and cost will be assessed in establishing a relative order of merit concerning past performance of all offerors. Information may be obtained from sources other than those identified by the Offeror.

c. Proposed Schedule. Project completion schedules will be reviewed to determine reasonableness and understanding of the requirements of the RFP.

d. Subcontracting Plan.

(1) Subcontracting Plan for Large Business: The plan will not be scored, but will be evaluated for acceptability (go/no-go) in accordance with AFARS 19.705.

(2) To be acceptable, subcontracting plans must by rated 71 percent or higher under the AFARS evaluation system. Any plan that is rated 70 percent or less under the AFARS evaluation system will be carefully considered for acceptability. If discussions with Offerors are necessary, those areas where the plan is deficient will be reviewed with the Offeror with the goal of correcting deficiencies. Due to requirements for review of the successful Offerors subcontracting plan by other agencies, the Government reserves the right to negotiate the final plan with the successful Offeror before award.

e. Price Proposal. The initial review of price proposals will result in a determination as to reasonableness compared to the independent cost estimate and funds budgeted for the project.

3.2. Summary. Proposals will be evaluated on their own merit, independently and as objectively as possible. Subjective comparisons will be limited to those areas where it is not feasible to quantify criteria, i.e., aesthetics and certain elements of information concerning past performance. Due to the obvious and unavoidable interrelationships among evaluation criteria; however, final determination of contract award will be based on the best composite offer, all factors considered. The evaluation will be conducted in accordance with the following process:

3.2.1. Proposals will be given a quality rating based on those factors discussed above.

3.2.2. After the quality ratings of proposals have been determined, proposals will be evaluated against price. Price is a very important factor; however, it is not point-scored. A price analysis will be performed on each proposal.

3.2.3. Once a competitive range is established, award may be made or discussions may be conducted with those falling within the competitive range, after which the best and final offers

would be solicited from those involved in the discussions. Following receipt of the best and final offers, each received offer would be point-scored, and an award made to that offeror whose offer, conforming to the solicitation, will be most advantageous to the Government, price and other factors considered. Please note that an award may be made on the basis of initial offers received, without discussion; therefore, the offeror should submit the best offer possible.

4. OPENING PROPOSALS AND DISCUSSIONS. No information regarding proposals received will be furnished prior to completion of evaluation, discussion, and award of the contract.

5. NOTIFICATION OF NONSELECTION. The Government will notify all offerors not selected, advising them of the proposal which was selected. Unsuccessful offerors are invited to request in writing a debriefing meeting with Louisville District Corps of Engineers staff.

FEROR: READ CAREFULLY - CHECK ALL APPLICABLE BOXES

SECTION 00610

REPRESENTATIONS, CERTIFICATIONS, AND OTHER STATEMENTS OF OFFEROR FOR NEGOTIATED CONSTRUCTION CONTRACTS

DATE OF OFFER: _____ DUNS NO. _____

SOLICITATION NO. _____ CAGE NO. _____

NAME AND ADDRESS OF OFFEROR: _____

_____

The offeror makes the following representations and certifications as part of the offer referenced above.

1. CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (APR 1985) FAR 52.203-2

(a) The offeror certifies that--

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to (i) those prices, (ii) the intention to submit an offer, or (iii) the methods or factors used to calculate the prices offered;

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory--

(1) Is the person in the offeror’s organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision _____ [*insert full name of person(s) in the offeror’s organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror’s organization*];

(ii) As an authorized agent, does certify that the principals name in subdivision (b)(2)(i) of this provision have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision.

(c) If the offeror deletes or modifies subparagraph (a)(2) of this provision, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of provision)

2. CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (APR 1991) FAR 52.203-11

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this certification.

(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or after December 23, 1989--

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan or cooperative agreement;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of $100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision or who fails to file or amend the disclosure form to be filed or amended by this provision, shall be subject to a civil penalty of not less than $10,000, and not more than $100,000, for each such failure.

(End of provision)

3. TAXPAYER IDENTIFICATION (OCT 1998) FAR 52.204-3

(a) **Definitions.**
“Common parent,” as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

“Taxpayer Identification Number (TIN),” as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

(b) All offerors must submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the IRS. If the resulting contract is subject to the payment reporting requirements described in Federal Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) **Taxpayer Identification Number (TIN).**

[ ] TIN: _____
[ ] TIN has been applied for.
[ ] TIN is not required because:
- **[ ]** Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;
- **[ ]** Offeror is an agency or instrumentality of a foreign government;
- **[ ]** Offeror is an agency or instrumentality the Federal Government;

(e) **Type of Organization.**

[ ] Sole proprietorship;
[ ] Partnership;
[ ] Corporate entity (not tax-exempt);
[ ] Corporate entity (tax-exempt);
[ ] Government entity (Federal, State, or local);
[ ] Foreign government;
[ ] International organization per 26 CFR 1.6049-4;
[ ] Other _____

(f) **Common Parent.**

[ ] Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.
[ ] Name and TIN of Common parent:

Name _____ TIN_____

(End of provision)

4. WOMEN-OWNED BUSINESS (OCT 1995) FAR 52.204-5

(a) **Representation.** The offeror represents that it **[ ]** is, **[ ]** is not a women-owned business concern.

(b) **Definition.** “Women-owned business concern,” as used in this provision, means a concern which is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(End of provision)

5. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (MAR 1996) FAR 52.209-5

(a) (1) The Offeror certifies, to the best of its knowledge and belief, that--

(i) The Offeror and/or any of its Principals--

(A) Are **[ ]** are not **[ ]** presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have **[ ]** have not **[ ]**, within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are **[ ]** are not **[ ]** presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in subdivision (a)(1)(i)(B) of this provision.

(ii) The Offeror has **[ ]** has not **[ ]**, within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) “Principals,” for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER SECTION 1001, TITLE 18, UNITED STATES CODE.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror’s responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

6. DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A TERRORIST COUNTRY (SEP 1994) DFARS 252.209-7001

(a) **Definitions.**

As used in this provision--

(1) “Government of a terrorist country” includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) “Terrorist country” means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405 (j)(i)(A)), to be a country the government of which has repeatedly provided support for acts of international terrorism. As of the date of this provision, terrorist countries include: Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria.

(3) “Significant interest” means--

(i) Ownership of or beneficial interest in 5 percent or more of the firm’s or subsidiary’s securities. Beneficial interest includes holding 5 percent or more of any class of the firm’s securities in “nominee shares,” “street names,” or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtedness of a firm.

(b) **Prohibition on award.** In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary, unless a waiver is granted by the Secretary of Defense.

(c) **Disclosure.** If the government of a terrorist country has a significant interest in the Offeror or a subsidiary of the Offeror, the Offeror shall disclose such interest in an attachment to its offer. If the Offeror is a subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include--

(1) Identification of each government holding a significant interest; and

(2) A description of the significant interest held by each government.

(End of provision)

7. SMALL BUSINESS PROGRAM REPRESENTATIONS (OCT 1998) FAR 52.219-1 (ALTERNATE I) (OCT 1998)

(a) (1) The standard industrial classification (SIC) code for this acquisition is 1522.

(2) The small business size standard is $17,000,000.

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) **Representations.** (1) The offeror represents as part of its offer that it **[ ]** is, **[ ]** is not a small business concern.

(2) (Complete only if offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents, for general statistical purposes, that it **[ ]** is **[ ]** is not a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) (Complete only if offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it **[ ]** is, **[ ]** is not a women-owned small business concern.

(4) (Complete if offeror represented itself as disadvantaged in paragraph (b)(2) of this provision). [The offeror shall check the category in which its ownership falls];

_____ Black American

_____ Hispanic American

_____ Native American (American Indians, Eskimos, Aleuts, or Native Hawaiians).

_____ Asian-Pacific American (persons with origins from Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Japan, China, Taiwan, Laos, Cambodia (Kampuchea), Vietnam, Korea, The Philippines, U.S. Trust Territory of the Pacific Islands (Republic of Palau), Republic of the Marshall Islands, Federated States of Micronesia, the Commonwealth of the Northern Mariana Islands, Guam, Samoa, Macao, Hong Kong, Fiji, Tonga, Kiribati, Tuvalu, or Nauru).

_____ Subcontinent Asian (Asian-Indian) American (persons with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, the Maldives Islands, or Nepal).

_____ Individual/concern, other than one of the preceding.

(c) **Definitions.**

“Small business concern,” as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and the size standard in paragraph (a) of this provision.

“Woman-owned small business concern,” as used in this provision, means a small business concern--

(1) Which is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) **Notice.** (1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm’s status as a small or small disadvantaged business concern in order to obtain a contract to be awarded under the preference programs established pursuant to sections 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall--

(i) Be punished by imposition of fine, imprisonment, or both;

(ii) Be subject to administrative remedies, including suspension and debarment; and

(iii) Be ineligible for participation in programs conducted under the authority of the Act.

(End of provision)

8. SMALL BUSINESS CONCERN REPRESENTATION FOR THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (JAN 1997) FAR 52.219-19

(a) **Definition.** "Emerging small business" as used in this solicitation, means a small business concern whose size is no greater than 50 percent of the numerical size standard applicable to the standard industrial classification code assigned to a contracting opportunity.

(b) **(Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.)** The Offeror **[ ]** is, **[ ]** is not an emerging small business.

(c) **(Complete only if the Offeror is a small business or an emerging small business, indicating its size range.)** Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts - see Paragraph 11(a)(2) Small Business Program Representations).

Number of Employees	**(Construction Solicitations)** Avg. Annual Gross Revenues
_____ 50 or fewer	_____ $1 million or less
_____ 51 - 100	_____ $1,000,001 - $2 million
_____ 101 -250	_____ $2,000,001 - $3.5 million
_____ 251 - 500	_____ $3,500,001 - $5 million
_____ 501 - 750	_____ $5,000,001 - $10 million
_____ 751 - 1,000	_____ $10,000,001 - $17 million
_____ Over 1,000	_____ Over $17 million

(End of provision)

9. CERTIFICATION OF NONSEGREGATED FACILITIES (APR 1984) FAR 52.222-21

(a) "Segregated facilities," as used in this provision, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise.

(b) By the submission of this offer, the offeror certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The offeror agrees that a breach of this certification is a violation of the Equal Opportunity clause in the contract.

(c) The offeror further agrees that (except where it has obtained identical certifications from proposed subcontractors for specific time periods) it will--

(1) Obtain identical certifications from proposed subcontractors before the award of subcontracts under which the subcontractor will be subject to the Equal Opportunity clause;

(2) Retain the certifications in the files; and

(3) Forward the following notice to the proposed subcontractors (except if the proposed subcontractors have submitted identical certifications for specific time periods):

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT
FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES

A Certification of Nonsegregated Facilities must be submitted before the award of a subcontract under which the subcontractor will be subject to the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).
NOTE: The penalty for making false statements in offers is prescribed in 18. U.S.C. 1001.

(End of provision)

10. PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (APR 1984) FAR 52.222-22

The offeror represents that--

(a) It **[ ]** has **[ ]** has not, participated in a previous contract or subcontract subject either to the Equal Opportunity clause of this solicitation, the clause originally contained in Section 310 of Executive Order No. 10925, or the clause contained in Section 201 of Executive Order No. 11114;

(b) It **[ ]** has, **[ ]** has not, filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

(End of provision)

11. CLEAN AIR AND WATER CERTIFICATION (APR 1984) FAR 52.223-1

The Offeror certifies that--

(a) Any facility to be used in the performance of this proposed contract **[ ]** is, **[ ]** is not listed on the Environmental Protection Agency (EPA) List of Violating Facilities;

(b) The Offeror will immediately notify the Contracting Officer, before award, of the receipt of any communication from the Administrator, or a designee, of the EPA, indicating that any facility that the Offeror proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and

(c) The Offeror will include a certification substantially the same as this certification, including this paragraph (c), in every nonexempt subcontract.

(End of provision)

12. CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (OCT 1996)

FAR 52.223-13

(a) Submission of this certification is a prerequisite for making or entering into this contract imposed by Executive Order 12969, August 8,1995.

(b) By signing this offer, the offeror certifies that--

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facilities is exempt for at least one of the following reasons: *(Check each block that is applicable.)*

[ ] (i) The facility does not manufacture, process or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

[ ] (ii) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

[ ] (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

[ ] (iv) The facility does not fall within the Standard Industrial Classification Code (SIC) designations 20 through 39 as set forth in section 19.102 of the Federal Acquisition Regulation; or

[ ] (v) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(End of provision)
(End of Section 00610)

SECTION 00700

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1. CONTRACTING OFFICER'S REPRESENTATIVE (DEC 1991) DFARS 252.201-7000

(a) *Definition*. "Contracting officer's representative" means an individual designated in accordance with subsection 201.602-2 of the Defense Federal Acquisition Regulation Supplement and authorized in writing by the Contracting Officer to perform specific technical or administrative functions.

(b) If the Contracting Officer designates a Contracting Officer's Representative (COR), the Contractor will receive a copy of the written designation. It will specify the extent of the COR's authority to act on behalf of the Contracting Officer. The COR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract.

(End of clause)

2. DEFINITIONS (OCT 1995)--ALTERNATE I (APR 1984) FAR 52.202-1 I

(a) "Head of the agency" (also called "agency head") or "Secretary" means the Secretary (or Attorney General, Administrator, Governor, Chairperson, or other chief official, as appropriate) of the agency, including any deputy or assistant chief official of the agency; and the term "authorized representative" means any person, persons, or board (other than the Contracting Officer) authorized to act for the head of the agency or Secretary.

(b) "Commercial component" means any component that is a commercial item.

(c) "Component" means any item supplied to the Federal Government as part of an end item or of another component.

(d) "Nondevelopmental item" means--

(1) Any previously developed item of supply used exclusively for governmental purposes by a Federal agency, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement;

(2) Any item described in paragraph (d)(1) of this definition that requires only minor modification or modifications of a type customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency; or

(3) Any item of supply being produced that does not meet the requirements of paragraph (d)(1) or (d)(2) solely because the item is not yet in use.

(e) "Contracting Officer" means a person with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the Contracting Officer acting within the limits of their authority as delegated by the Contracting Officer.

(f) Except as otherwise provided in this contract, the term "subcontracts" includes, but is not limited to, purchase orders and changes and modifications to purchase orders under this contract.

(End of clause)

3. GRATUITIES (APR 1984) FAR 52.203-3

(a) The right of the Contractor to proceed may be terminated by written notice if, after notice and hearing, the agency head or a designee determines that the Contractor, its agent, or another representative--

(1) Offered or gave a gratuity (e.g., an entertainment or gift) to an officer, official, or employee of the Government; and

(2) Intended, by the gratuity, to obtain a contract or favorable treatment under a contract.

(b) The facts supporting this determination may be reviewed by any court having lawful jurisdiction.

(c) If this contract is terminated under paragraph (a) of this clause, the Government is entitled--

(1) To pursue the same remedies as in a breach of the contract; and

(2) In addition to any other damages provided by law, to exemplary damages of not less than 3 nor more than 10 times the cost incurred by the Contractor in giving gratuities to the person concerned, as determined by the agency head or a designee. (This subparagraph (c)(2) is applicable only if this contract uses money appropriated to the Department of Defense.)

(d) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

4. COVENANT AGAINST CONTINGENT FEES (APR 1984) FAR 52.203-5

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annual this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a contractor and subject to the contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract or any basis other than the merits of the matter.

(End of clause)

5. ANTI-KICKBACK PROCEDURES (JUL 1995) FAR 52.203-7

(a) *Definitions*.

"Kickback," as used in this clause, means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided, directly or indirectly, to any prime Contractor, prime Contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a subcontract relating to a prime contract.

"Person," as used in this clause, means a corporation, partnership, business association of any kind, trust, joint-stock company, or individual.

"Prime contract," as used in this clause, means a contract or contractual action entered into by the United States for the purpose of obtaining supplies, materials, equipment or services of any kind.

"Prime Contractor" as used in this clause, means a person who has entered into a prime contract with the United States.

"Prime Contractor employee," as used in this clause, means any officer, partner, employee, or agent of a prime Contractor.

"Subcontract," as used in this clause, means a contract or contractual action entered into by a prime Contractor or subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind under a prime contract.

"Subcontractor," as used in this clause, (1) means any person, other than the prime Contractor, who offers to furnish or furnishes any supplies, materials, equipment, or services of any kind under a prime contract or a subcontract entered into in connection with such prime contract, and (2) includes any person who offers to furnish or furnishes general supplies to the prime Contractor or a higher tier subcontractor.

"Subcontractor employee," as used in this clause, means any officer, partner, employee, or agent of a subcontractor.

(b) The Anti-Kickback Act of 1986 (41 U.S.C. 51-58) (the Act), prohibits any person from--

(1) Providing or attempting to provide or offering to provide any kickback;

(2) Soliciting, accepting, or attempting to accept any kickback; or

(3) Including, directly or indirectly, the amount of any kickback in the contract price charged by a prime Contractor to the United States or in the contract price charged by a subcontractor to a prime Contractor or higher tier subcontractor.

(c)(1) The Contractor shall have in place and follow reasonable procedures designed to prevent and detect possible violations described in paragraph (b) of this clause in its own operations and direct business relationships.

(2) When the Contractor has reasonable grounds to believe that a violation described in paragraph (b) of this clause may have occurred, the Contractor shall promptly report in writing the possible violation. Such reports shall be made to the inspector general of the contracting agency, the head of the contracting agency if the agency does not have an inspector general, or the Department of Justice.

(3) The Contractor shall cooperate fully with any Federal agency investigating a possible violation described in paragraph (b) of this clause.

(4) The Contracting Officer may (i) offset the amount of the kickback against any monies owed by the United States under the prime contract and/or (ii) direct that the Prime Contractor withhold from sums owed a subcontractor under the prime contract the amount of the kickback. The Contracting Officer may order that monies withheld under subdivision (c)(4)(ii) of this clause be paid to the Government unless the Government has already offset those monies under subdivision (c)(4)(i) of this clause. In either case, the Prime Contractor shall notify the Contracting Officer when the monies are withheld.

(5) The Contractor agrees to incorporate the substance of this clause, including subparagraph (c)(5) but excepting subparagraph (c)(1), in all subcontracts under this contract which exceed $100,000.

(End of clause)

6. CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997) FAR 52.203-8

(a) If the Government receives information that a contractor or a person has engaged in conduct constituting a violation of subsection (a), (b), (c), or (d) of Section 27 of the Office of Federal Procurement Policy Act (41 U.S.C. 423) (the Act), as amended by section 4304 of the 1996 National Defense Authorization Act for Fiscal Year 1996 (Pub.L. 104-106), the Government may--

(1) Cancel the solicitation, if the contract has not yet been awarded or issued; or

(2) Rescind the contract with respect to which--

(i) The Contractor or someone acting for the Contractor has been convicted for an offense where the conduct constitutes a violation of subsection 27 (a) or (b) of the Act for the purpose of either--

(A) Exchanging the information covered by such subsections for anything of value; or

(B) Obtaining or giving anyone a competitive advantage in the award of a Federal agency procurement contract; or

(ii) The head of the contracting activity has determined, based upon a preponderance of the evidence, that the Contractor or someone acting for the Contractor has engaged in conduct constituting an offense punishable under subsections 27(e) (1) of the Act.

(b) If the Government rescinds the contract under paragraph (a) of this clause, the Government is entitled to recover, in addition to any penalty prescribed by law, the amount expended under the contract.

(c) The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law, regulation, or under this contract.

(End of clause)

7. PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997) FAR 52.203-10

(a) The Government, at its election, may reduce the price of a fixed-price type contract and the total cost and fee under a cost-type contract by the amount of profit or fee determined as set forth in paragraph (b) of this clause if the head of the contracting activity or designee determines that there was a violation of subsection 27(a), (b), or (c) of the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 423), as implemented in section 3.104 of the Federal Acquisition Regulation. In the case of a contract modification, the fee subject to reduction is the fee specified in the particular contract modification at the time of execution, except as provided in subparagraph (b)(5) of this clause.

(b) The price or fee reduction referred to in paragraph (a) of this clause shall be--

(1) For cost-plus-fixed-fee contracts, the amount of the fee specified in the contract at the time of award;

(2) For cost-plus-incentive-fee contracts, the target fee specified in the contract at the time of award, notwithstanding any minimum fee or "fee floor" specified in the contract;

(3) For cost-plus-award-fee contracts--

(i) For base fee established in the contract at the time of contract award;

(ii) If no base fee is specified in the contract, 30 percent of the amount of each award fee otherwise payable to the Contractor for each award fee evaluation period or at each award fee determination point.

(4) For fixed-price-incentive contracts, the Government may--

(i) Reduce the contract target price and contract target profit both by an amount equal to the initial target profit specified in the contract at the time of contract award; or

(ii) If an immediate adjustment to the contract target price and contract target profit would have a significant adverse impact on the incentive price revision relationship under the contract, or adversely affect the contract financing provisions, the Contracting Officer may defer such adjustment until establishment of the total final price of the contract. The total final price established in accordance with the incentive price revision provisions of the contract shall be reduced by an amount equal to the initial target profit specified in the contract at the time of contract award and such reduced price shall be the total final contract price.

(5) For firm-fixed price contracts, by 10 percent of the initial contract price or a profit amount determined by the Contracting Officer from records or documents in existence prior to the date of the contract award.

(c) The Government may, at its election, reduce a prime contractor's price or fee in accordance with the procedures of paragraph (b) of this clause for violations of the Act by its subcontractors by an amount not to exceed the amount of profit or fee reflected in the subcontract at the time the subcontract was first definitively priced.

(d) In addition to the remedies in paragraphs (a) and (c) of this clause, the Government may terminate this contract for default. The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

8. LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (JUN 1997) FAR 52.203-12

(a) *Definitions.*

"Agency," as used in this clause, means executive agency as defined in 2.101.

"Covered Federal action," as used in this clause, means any of the following Federal actions:

(1) The awarding of any Federal contract.

(2) The making of any Federal grant.

(3) The making of any Federal loan.

(4) The entering into of any cooperative agreement.

(5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

"Indian tribe" and "tribal organization," as used in this clause, have the meaning provided in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) and include Alaskan Natives.

"Influencing or attempting to influence," as used in this clause, means making, with the intent to influence, any communication to or appearance before an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any covered Federal action.

"Local government," as used in this clause, means a unit of government in a State and, if chartered, established, or otherwise recognized by a State for the performance of a governmental duty, including a local public authority, a special district, an intrastate district, a council of governments, a sponsor group representative organization, and any other instrumentality of a local government.

"Officer or employee of an agency," as used in this clause, includes the following individuals who are employed by an agency:

(1) An individual who is appointed to a position in the Government under title 5, United States Code, including a position under a temporary appointment.

(2) A member of the uniformed services, as defined in subsection 101(3), title 37, United States Code.

(3) A special Government employee, as defined in section 202, title 18, United States Code.

(4) An individual who is a member of a Federal advisory committee, as defined by the Federal advisory Committee Act, title 5, United States Code, appendix 2.

"Person," as used in this clause, means an individual, corporation, company, association, authority, firm, partnership, society, State, and local government, regardless of whether such entity is operated for profit, or not for profit. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Reasonable compensation," as used in this clause, means, with respect to a regularly employed officer or employee of any person, compensation that is consistent with the normal compensation for such officer or employee for work that is not furnished to, not funded by, or not furnished in cooperation with the Federal Government.

"Reasonable payment," as used in this clause, means, with respect to professional and other technical services, a payment in an amount that is consistent with the amount normally paid for such services in the private sector.

"Recipient," as used in this clause, includes the Contractor and all subcontractors. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Regularly employed," as used in this clause, means, with respect to an officer or employee of a person requesting or receiving a Federal contract, an officer or employee who is employed by such person for at least 130 working days within 1 year immediately preceding the date of the submission that initiates

agency consideration of such person for receipt of such contract. An officer or employee who is employed by such person for less than 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person shall be considered to be regularly employed as soon as he or she is employed by such person for 130 working days.

"State," as used in this clause, means a State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, a territory or possession of the United States, an agency or instrumentality of a State, and multi-State, regional, or interstate entity having governmental duties and powers.

(b) *Prohibitions*.

(1) Section 1352 of title 31, United States Code, among other things, prohibits a recipient of a Federal contract, grant, loan, or cooperative agreement from using appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan or cooperative agreement.

(2) The Act also requires Contractors to furnish a disclosure if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

(3) The prohibitions of the Act do not apply under the following conditions:

(i) *Agency and legislative liaison by own employees*.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of a payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action if the payment is for agency and legislative liaison activities not directly related to a covered Federal action.

(B) For purposes of subdivision (b)(3)(i)(A) of this clause, providing any information specifically requested by an agency or Congress is permitted at any time.

(C) The following agency and legislative liaison activities are permitted at any time where they are not related to a specific solicitation for any covered Federal action:

(1) Discussing with an agency the qualities and characteristics (including individual demonstrations) of the person's products or services, conditions or terms of sale, and service capabilities.

(2) Technical discussions and other activities regarding the application or adaptation of the person's products or services for an agency's use.

(D) The following agency and legislative liaison activities are permitted where they are prior to formal solicitation of any covered Federal action--

(1) Providing any information not specifically requested but necessary for an agency to make an informed decision about initiation of a covered Federal action;

(2) Technical discussions regarding the preparation of an unsolicited proposal prior to its official submission; and

(3) Capability presentations by persons seeking awards from an agency pursuant to the provisions of the Small Business Act, as amended by Pub. L. 95-507, and subsequent amendments.

(E) Only those services expressly authorized by subdivision (b)(3)(i)(A) of this clause are permitted under this clause.

(ii) *Professional and technical services*.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of--

(1) A payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action, if payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action.

(2) Any reasonable payment to a person, other than an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action if the payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action. Persons other than officers or employees of a person requesting or receiving a covered Federal action include consultants and trade associations.

(B) For purposes of subdivision (b)(3)(ii)(A) of this clause, "professional and technical services" shall be limited to advice and analysis directly applying any professional or technical discipline. For example, drafting of a legal document accompanying a bid or proposal by a lawyer is allowable. Similarly, technical advice provided by an engineer on the performance of operational capability of a piece of equipment rendered directly in the negotiation of a contract is allowable. However, communications with the intent to influence made by a professional (such as a licensed lawyer) or a technical person (such as a licensed accountant) are not allowable under this section unless they provide advice and analysis directly applying their professional or technical expertise and unless the advice or analysis is rendered directly and solely in the preparation, submission or negotiation of a covered Federal action. Thus, for example, communications with the intent to influence made by a lawyer that do not provide legal advice or analysis directly and solely related to the legal aspects of this or her client's proposal, but generally advocate one proposal over another are not allowable under this section because the lawyer is not providing professional legal services. Similarly, communications with the intent to influence made by an engineer providing an engineering analysis prior to the preparation or submission of a bid or proposal are not allowable under this section since the engineer is providing technical services but not directly in the preparation, submission or negotiation of a covered Federal action.

(C) Requirements imposed by or pursuant to law as a condition for receiving a covered Federal award include those required by law or regulation and any other requirements in the actual award documents.

(D) Only those services expressly authorized by subdivisions (b)(3)(ii)(A)(1) and (2) of this clause are permitted under this clause.

(E) The reporting requirements of FAR 3.803(a) shall not apply with respect to payments of reasonable compensation made to regularly employed officers or employees of a person.

(c) *Disclosure*.

(1) The Contractor who requests or receives from an agency a Federal contract shall file with that agency a disclosure form, OMB standard form LLL, Disclosure of Lobbying Activities, if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under subparagraph (b)(1) of this clause, if paid for with appropriated funds.

(2) The Contractor shall file a disclosure form at the end of each calendar quarter in which there occurs any event that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under subparagraph (c)(1) of this clause. An event that materially affects the accuracy of the information reported includes--

(i) A cumulative increase of $25,000 or more in the amount paid or expected to be paid for influencing are attempting to influence a covered Federal action; or

(ii) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or

(iii) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempting to influence a covered Federal action.

(3) The Contractor shall require the submittal of a certification, and if required, a disclosure form by any person who requests or receives any subcontract exceeding $100,000 under the Federal contract.

(4) All subcontractor disclosure forms (but not certifications) shall be forwarded from tier to tier until received by the prime Contractor. The prime Contractor shall submit all disclosures to the Contracting Officer at the end of the calendar quarter in which the disclosure form is submitted by the subcontractor. Each subcontractor certification shall be retained in the subcontract file of the awarding Contractor.

(d) *Agreement*. The Contractor agrees not to make any payment prohibited by this clause.

(e) *Penalties*.

(1) Any person who makes an expenditure prohibited under paragraph (a) of this clause or who fails to file or amend the disclosure form to be filed or amended by paragraph (b) of this clause shall be subject to civil penalties as provided for by 31 U.S.C. 1352. An imposition of a civil penalty does not prevent the Government from seeking any other remedy that may be applicable.

(2) Contractors may rely without liability on the representation made by their subcontractors in the certification and disclosure form.

(f) *Cost allowability*. Nothing in this clause makes allowable or reasonable any costs which would otherwise be unallowable or unreasonable. Conversely, costs made specifically unallowable by the requirements in this clause will not be made allowable under any other provision.

(End of clause)

9. SPECIAL PROHIBITION ON EMPLOYMENT (NOV 1995) DFARS 252.203-7001

(a) *Definitions*. As used in this clause--

(1) "Arising out of a contract with the DoD" means any act in connection with--

(i) Attempting to obtain,

(ii) Obtaining, or

(iii) Performing a contract or first-tier subcontract of any agency, department, or component of the Department of Defense (DoD).

(2) "Conviction of fraud or any other felony" means any conviction for fraud or a felony in violation of state or Federal criminal statutes, whether entered on a verdict or plea, including a plea of *nolo contendere*, for which sentence has been imposed.

(3) "Date of conviction" means the date judgment was entered against the individual.

(b) 10 U.S.C. 2408 provides that any individual who is convicted after September 29, 1988, of fraud or any other felony arising out of a contract with the DoD is prohibited from:

(1) Working in a management or supervisory capacity on any DoD contract or first-tier subcontract;

(2) Serving on the board of directors of any DoD contractor or fist-tier subcontractor; or

(3) Serving as a consultant to any DoD contractor or first-tier subcontractor.

(c) Unless waived, the prohibition in paragraph (b) applies for five years from the date of conviction.

(d) 10 U.S.C. 2408 further provides that a defense contractor or first-tier subcontractor shall be subject to a criminal penalty of not more than $500,000 if convicted of knowingly--

(1) Employing a person under a prohibition specified in paragraph (b) of this clause; or

(2) Allowing such a person to serve on the board of directors of the contractor or first-tier subcontractor.

(c) In addition to the criminal penalties contained in 10 U.S.C. 2408, the Government may consider other available remedies, such as--

(1) Suspension or debarment;

(2) Cancellation of the contract at no cost to the Government; or

(3) Termination of the contract for default.

(f) The Contractor may submit written requests for waiver of the prohibitions in paragraph (b) of this clause to the Contracting Officer. Requests shall clearly identify--

(1) The person involved;

(2) The nature of the conviction and resultant sentence or punishment imposed;

(3) The reasons for the requested waiver, and

(4) An explanation of why a waiver is in the interest of national security.

(g) The Contractor agrees to include the substance of this clause, appropriately modified to reflect the identify and relationship of the parties, in all first-tier subcontracts exceeding the simplified acquisition threshold in part 13 of the Federal Acquisition Regulation, except those for commercial items or components.

(h) Pursuant to 10 U.S.C. 2408(c), defense contractors and subcontractors may obtain information as to whether a particular person has been convicted of fraud or any other felony arising out of a contract with the DoD by contacting The Office of Justice Programs, The Denial of Benefits Office, U.S. Department of Justice, telephone (202) 307-1065.

(End of clause)

10. DISPLAY OF DOD HOTLINE POSTER (DEC 1991) DFARS 252.203-7002

(a) The Contractor shall display prominently in common work areas within business segments performing work under Department of Defense (DoD) contracts, DoD Hotline Posters prepared by the DoD Office of the Inspector General.

(b) DoD Hotline Posters may be obtained from the DoD Inspector General, ATTN: Defense Hotline, 400 Army Navy Drive, Washington, DC 22202-2884.

(c) The Contractor need not comply with paragraph (a) of this clause if it has established a mechanism, such as a hotline, by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports.

(End of clause)

11. PRINTING/COPYING DOUBLE-SIDED ON RECYCLED PAPER (JUN 1996) FAR 52.204-4

(a) In accordance with Executive Order 12873, dated October 20, 1993, as amended by Executive Order 12995, dated March 25, 1996, the Offeror/Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed/copied double-sided on recycled paper that has at least 20 percent postconsumer material.

(b) The 20 percent standard applies to high-speed copier paper offset paper, forms bond, computer printout paper, carbonless paper, file folders, white woven envelopes, and other uncoated printed and writing paper such as writing and office paper, book paper, cotton fiber paper, and cover stock. An alternative to meeting the 20 percent postconsumer material standards is 50 percent recovered material content of certain industrial by-products.

(End of clause)

12. REQUIRED CENTRAL CONTRACTOR REGISTRATION (MAR 1998) DFARS 52.204-7004

(a) Definitions. As used in this clause—

(1) Central Contractor Registration (CCR) database means the primary DoD repository for contractor information required for the conduct of business with DoD.

(2) Data Universal Numbering System (DUNS) number means the 9-digit number assigned by Dun and Bradstreet Information Services to identify unique business entities.

(3) Data Universal Numbering System+4 (DUNS+4) number means the DUNS number assigned by Dun and Bradstreet plus a 4-digit suffix that may be assigned by a parent (controlling) business concern. This 4-digit suffix may be assigned at the discretion of the parent business concern for such purposes as identifying subunits or affiliates of the parent business concern.

(4) Registered in the CCR database means that all mandatory information including the DUNS number or the DUNS+4 number, if applicable, and the corresponding Commercial and Government Entity (CAGE) code, is in the CCR database; the DUNS number and the CAGE code have been validated; and all edits have been successfully completed.

(b) (1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee must be registered in the CCR database prior to award, during the performance, and through final payment of any contract resulting from this solicitation, except for awards to foreign vendors for work to be performed outside the United States.

(2) The offeror shall provide its DUNS or, if applicable, its DUNS+4 number with its offer, which will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(3) Lack of registration in the CCR database will make an offer ineligible for award.

(4) DoD has established a goal of registering an applicant in the CCR database within 48 hours after receipt of a complete and accurate application via the Internet. However, registration of an applicant submitting an application through a method other than the Internet may take up to 30 days. Therefore, offerors that are not registered should consider applying for registration immediately upon receipt of this solicitation.

(c) The Contractor is responsible for the accuracy and completeness of the data within the CCR and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after initial registration, the Contractor is required to confirm on an annual basis that its information in the CCR database is accurate and complete.

(d) Offerors and contractors may obtain information on registration and annual confirmation requirements by calling 1-888-227-2423, or via the Internet at http://ccr.edi.disa.mil.

(End of clause)

13. PROVISION OF INFORMATION TO COOPERATIVE AGREEMENT HOLDERS (DEC 1991) DFARS 252.205-7000

(a) *Definition*.

"Cooperative agreement holder" means a State or local government; a private, nonprofit organization; a tribal organization (as defined in section 4(c) of the Indian Self-Determination and Education Assistance Act (Pub. L. 93-268; 25 U.S.C. 450(c)); or an economic enterprise (as defined in section 3(e) of the Indian Financing Act of 1974 (Pub. L. 93-362; 25 U.S.C. 1452(e)) whether such economic enterprise is organized for profit or nonprofit purposes; which has an agreement with the Defense Logistics Agency to furnish procurement technical assistance to business entities.

(b) The Contractor shall provide cooperative agreement holders, upon their request, with a list of those appropriate employees or offices responsible for entering into subcontracts under defense contracts. The list shall include the business address, telephone number, and area of responsibility of each employee or office.

(c) The Contractor need not provide the listing to a particular cooperative agreement holder more frequently than once a year.

(End of clause)

14. PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT (JUL 1995) FAR 52.209-6

(a) The Government suspends or debars Contractors to protect the Government's interests. The Contractor shall not enter into any subcontract in excess of $25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.

(b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed $25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principals, is or is not debarred, suspended, or proposed for debarment by the Federal Government.

(c) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs). The notice must include the following:

(1) The name of the subcontractor.

(2) The Contractor's knowledge of the reasons for the subcontractor being on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(3) The compelling reasons(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded From Federal Procurement and Nonprocurement Programs.

(4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government's interest when dealing with such subcontractor in view of the specific basis for the party's debarment, suspension, or proposed debarment.

(End of clause)

15. DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS (SEP 1990)

FAR 52.211-15

NOTE: This clause applies only to military contracts.

This is a rated order certified for national defense use, and the contractor shall follow all the requirements of the Defense Priorities and Allocations System regulation (15 CFR 700).

(End of clause)

16. VARIATION IN ESTIMATED QUANTITY (APR 1984) FAR 52.211-18

If the quantity of a unit-priced item in this contract is an estimated quantity and the actual quantity of the unit-priced item varies more than 15 percent above or below the estimated quantity, an equitable adjustment in the contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 115 percent or below 85 percent of the estimated quantity. If the quantity variation is such as to cause an increase in the time necessary for completion, the Contractor may request, in writing, an extension of time, to be received by the Contracting Officer within 10 days from the beginning of the delay, or within such further period as may be granted by the Contracting Officer before the date of final settlement of the contract. Upon the receipt of a written request for an extension, the Contracting Officer shall ascertain the facts and make an adjustment for extending the completion date as, in the judgment of the Contracting Officer, is justified.

(End of clause)

17. AUDIT AND RECORDS--SEALED BIDDING (OCT 1997) FAR 52.214-26

NOTE: This clause applies only to sealed bid contracts.

(a) As used in this clause, "records" includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or in any other form.

(b) *Cost or pricing data*. If the Contractor has been required to submit cost or pricing data in connection with the pricing of any modification to this contract, the Contracting Officer, or an authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right to examine and audit all of the Contractor's records, including computations and projections, related to--

(1) The proposal for the modification;
(2) The discussions conducted on the proposal(s), including those related to negotiating;
(3) Pricing of the modification; or
(4) Performance of the modification.

(c) *Comptroller General*. In the case of pricing any modification, the Comptroller General of the United States, or an authorized representative, shall have the same rights as specified in paragraph (b) of this clause.

(d) *Availability*. The Contractor shall make available at its office at all reasonable times the materials described in paragraph (b) of this clause, for examination, audit, or reproduction, until 3 years after final payment under this contract, or for any other period specified in Subpart 4.7 of the Federal Acquisition Regulation (FAR). FAR Subpart 4.7, Contractor Records Retention, in effect on the date of this contract, is incorporated by reference in its entirety and made a part of this contract.

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement.

(2) Records pertaining to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to the performance of this contract shall be made available until disposition of such appeals, litigation, or claims.

(e) The Contractor shall insert a clause containing all the provisions of this clause, including this paragraph (e), in all subcontracts expected to exceed the threshold in FAR 15.403-4(a)(1) for submission of cost or pricing data.

(End of clause)

18. PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA--MODIFICATIONS--SEALED BIDDING (OCT 1997) FAR 52.214-27

NOTE: This clause applies only to sealed bid contracts

(a) This clause shall become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for the submission of cost or pricing data at FAR 15.403-4(a)(1), except that this clause does not apply to a modification if an exception under FAR 15.403-1(b) applies.

(b) If any price, including profit, negotiated in connection with any modification under this clause, was increased by any significant amount because (1) the Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data, (2) a subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data, or (3) any of these parties furnished data of any description that were not accurate, the price shall be reduced accordingly and the contract shall be modified to reflect the reduction. This right to a price reduction is limited to that resulting from defects in data relating to modifications for which this clause becomes operative under paragraph (a) of this clause.

(c) Any reduction in the contract price under paragraph (b) of this clause due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which (1) the actual subcontract or (2) the actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(d)(1) If the Contracting Officer determines under paragraph (b) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2)(i) Except as prohibited by subdivision (d)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if--

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the date of agreement on the price of the contract (or price of the modification) and that the data were not submitted before such date.

(ii) An offset shall not be allowed if--

(A) The understated data was known by the Contractor to be understated when the Certificate of Current Cost or Pricing Data was signed; or

(B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data has been submitted before the date of agreement on price.

(e) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621 (a)(2); and

(2) A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data which were incomplete, inaccurate, or noncurrent.

(End of clause)

19. SUBCONTRACTOR COST OR PRICING DATA--MODIFICATIONS-SEALED BIDDING (OCT 1997) FAR 52.214-28

NOTE: This clause applies only to sealed bid contracts.

(a) The requirements of paragraphs (b) and (c) of this clause shall (1) become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), and (2) be limited to such modifications.

(b) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modifications involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specified identification in writing), unless an exception under FAR 15.403-1(b) applies.

(c) The Contractor shall require the subcontractor to certify in substantially the form prescribed in subsection FAR 15.406-2 that, to the best of its knowledge and belief, the data submitted under paragraph (b) of this clause were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(d) The Contractor shall insert the substance of this clause, including this paragraph (d), in each subcontract that, when entered into, exceeds the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1).

(End of clause)

20. AUDIT AND RECORDS--NEGOTIATION (AUG 1996) FAR 52.215-2

NOTE: This clause applies only to negotiated contracts.

(a) As used in this clause, "records" includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or in any other form.

(b) *Examination of costs*. If this is a cost-reimbursement, incentive, time-and-materials, labor-hour, or price redeterminable contract, or any combination of these, the Contractor shall maintain and the Contracting Officer, or an authorized representative of the Contracting Officer, shall have the right to examine and audit all records and other evidence sufficient to reflect properly all costs claimed to have been incurred or anticipated to be incurred directly or indirectly in performance of this contract. This right of examination shall include inspection at all reasonable times of the Contractor's plants, or parts of them, engaged in performing the contract.

(c) *Cost or pricing data*. If the Contractor has been required to submit cost or pricing data in connection with any pricing action relating to this contract, the Contracting Officer, or an authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right to examine and audit all of the Contractor's records, including computations and projections, related to--

(1) The proposal for the contract, subcontract, or modification;

(2) The discussions conducted on the proposal(s), including those related to negotiating;

(3) Pricing of the contract, subcontract, or modification; or

(4) Performance of the contract, subcontract or modification.

(d) *Comptroller General*.--(1) The Comptroller General of the United States, or an authorized representative, shall have access to and the right to examine any of the Contractor's directly pertinent records involving transactions related to this contract or a subcontract hereunder.

(2) This paragraph may not be construed to require the Contractor or subcontractor to create or maintain any record that the Contractor or subcontractor does not maintain in the ordinary course of business or pursuant to a provision of law.

(e) *Reports*. If the Contractor is required to furnish cost, funding, or performance reports, the Contracting Officer or an authorized representative of the Contracting Officer shall have the right to examine and audit the supporting records and materials, for the purpose of evaluating (1) the effectiveness of the Contractor's policies and procedures to produce data compatible with the objectives of these reports and (2) the data reported.

(f) *Availability*. The Contractor shall make available at its office at all reasonable times the records, materials, and other evidence described in paragraphs (a), (b), (c), (d), and (e) of this clause, for examination, audit, or reproduction, until 3 years after final payment under this contract, or for any shorter period specified in Subpart 4.7, Contractor Records Retention, of the Federal Acquisition Regulation (FAR), or for any longer period required by statute or by other clauses of this contract. In addition--

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement; and

(2) Records relating to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to this contract shall be made available until such appeals, litigation, or claims are finally resolved.

(g) The Contractor shall insert a clause containing all the terms of this clause, including this paragraph (g), in all subcontracts under this contract that exceed the simplified acquisition threshold, and--

(1) That are cost-reimbursement, incentive, time-and-materials, labor-hour, or price-redeterminable type or any combination of these;

(2) For which cost or pricing data are required; or

(3) That require the subcontractor to furnish reports as discussed in paragraph (c) of this clause.

The clause may be altered only as necessary to identify properly the contracting parties and the Contracting Officer under the Government prime contract.

(End of clause)

21. PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA (OCT 1997) FAR 52.215-10

NOTE: This clause applies only to negotiated contracts.

(a) If any price, including profit or fee, negotiated in connection with this contract, or any cost reimbursable under this contract, was increased by any significant amount because --(1) The Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data; (2) A subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data, or (3) Any of these parties furnished data of any description that were not accurate, the price or cost shall be reduced accordingly and the contract shall be modified to reflect the reduction.

(b) Any reduction in the contract price under paragraph (a) of this clause due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which (1) The actual subcontract; or (2) The actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(c)(1) If the Contracting Officer determines under paragraph (a) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2)(i) Except as prohibited by subdivision (c)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if--

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the "as of" date specified on its Certificate of Current Cost or Pricing Data, and that the data were not submitted before such date

(ii) An offset shall not be allowed if--

(A) The understated data was known by the Contractor to be understated before the "as of" date specified on its Certificate of Current Cost or Pricing Data; or

(B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data

has been submitted before the "as of" date specified on its Certificate of Current Cost or Pricing Data.

(d) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable under payment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621(a)(2); and

(2) A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data which were incomplete, inaccurate, or noncurrent.

(End of clause)

22. SUBCONTRACTOR COST OR PRICING DATA (OCT 1997) FAR 52.215-12

NOTE: This clause applies only to negotiated contracts.

(a) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modification involving a pricing adjustment expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.403-1 applies.

(b) The Contractor shall require the subcontractor to certify in substantially the form prescribed in subsection 15.406-2 that, to the best of its knowledge and belief, the data submitted under paragraph (a) of this clause were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(c) In each subcontract that exceeds the threshold for submission of cost or pricing data at FAR 15.403-4, when entered into, the Contractor shall insert either--

(1) The substance of this clause, including this paragraph (c), if paragraph (a) of this clause requires submission of cost or pricing data for the subcontract; or

(2) The substance of the clause at FAR 52.215-13, Subcontractor Cost or Pricing Data--Modifications.

(End of clause)

23. TERMINATION OF DEFINED BENEFIT PENSION PLANS (OCT 1997) FAR 52.215-15

NOTE: This clause applies only to negotiated contracts.

The Contractor shall promptly notify the Contracting Officer in writing when it determines that it will terminate a defined benefit pension plan or otherwise recapture such pension fund assets. If pension fund assets revert to the Contractor or are constructively received by it under a termination or otherwise, the Contractor shall make a refund or give a credit to the Government for its equitable share as required by FAR 31.205-6(j)(4). The Contractor shall include the substance of this clause in all subcontracts under this contract which meet the applicability requirements of FAR 15.408(g).

(End of clause)

24. REVERSION OR ADJUSTMENT OF PLANS FOR POSTRETIREMENT BENEFITS (PRB) OTHER THAN PENSIONS (OCT 1997) FAR 52.215-18

NOTE: This clause applies only to negotiated contracts.

The Contractor shall promptly notify the Contracting Officer in writing when it determines that it will terminate or reduce a PRB plan. If PRB fund assets revert, or inure, to the Contractor or are constructively received by it under a plan termination or otherwise, the Contractor shall make a refund or give a credit to the Government for its equitable share as required by FAR 31.205-6(o)(6). The Contractor shall include the substance of this clause in all subcontracts under this contract which meet the applicability requirements of FAR 15.408(j)

(End of clause)

25. NOTIFICATION OF OWNERSHIP CHANGES (OCT 1997) FAR 52.215-19

NOTE: This clause applies only to negotiated contracts.

(a) The Contractor shall make the following notifications in writing:

(1) When the Contractor becomes aware that a change in its ownership has occurred, or is certain to occur, which could result in changes in the valuation of its capitalized assets in the accounting records, the Contractor shall notify the Administrative Contracting Officer (ACO) within 30 days.

(2) The Contractor shall also notify the ACO within 30 days whenever changes to asset valuations or any other cost changes have occurred or are certain to occur as a result of a change in ownership.

(b) The Contractor shall-- (1) Maintain current, accurate, and complete inventory records of assets and their costs; (2) Provide the ACO or designated representative ready access to the records upon request; (3) Ensure that all individual and grouped assets, their capitalized values, accumulated depreciation or amortization, and remaining useful lives are identified accurately before and after each of the Contractor's ownership changes; and (4) Retain and continue to maintain depreciation and amortization schedules based on the asset records maintained before each Contractor ownership change.

(c) The Contractor shall include the substance of this clause in all subcontracts under this contract which meet the applicability requirement of FAR 15.408(k).

(End of clause)

26. PRICING ADJUSTMENTS (DEC 1991) DFARS 252.215-7000

NOTE: This clause applies only to negotiated contracts.

The term "pricing adjustment," as used in paragraph (a) of the clauses entitled "Price Reduction for Defective Cost or Pricing Data - Modifications," "Subcontractor Cost or Pricing Data," and "Subcontractor Cost or Pricing Data - Modifications," means the aggregate increases and/or decreases in cost plus applicable profits.

(End of clause)

27. UTILIZATION OF SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS CONCERNS (JUN 1997) FAR 52.219-8

(a) It is the policy of the United States that small business concerns, small business concerns owned and controlled by socially and economically disadvantaged individuals and small business concerns owned and controlled by women shall have the maximum practicable opportunity to participate in performing contracts let by any Federal agency, including contracts and subcontracts for subsystems, assemblies, components, and related services for major systems. It is further the policy of the United States that its

prime contractors establish procedures to ensure the timely payment of amounts due pursuant to the terms of their subcontracts with small business concerns, small business concerns owned and controlled by socially and economically disadvantaged individuals and small business concerns owned and controlled by women.

(b) The Contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with efficient contract performance. The Contractor further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the awarding agency of the United States as may be necessary to determine the extent of the Contractor's compliance with this clause.

(c) As used in this contract, the term "small business concern" shall mean a small business as defined pursuant to section 3 of the Small Business Act and relevant regulations promulgated pursuant thereto. The term "small business concern owned and controlled by socially and economically disadvantaged individuals" shall mean a small business concern (1) which is at least 51 percent unconditionally owned by one or more socially and economically disadvantaged individuals; or, in the case of any publicly owned business, at least 51 per centum of the stock of which is unconditionally owned by one or more socially and economically disadvantaged individuals; and (2) whose management and daily business operations are controlled by one or more of such individuals. This term also means a small business concern that is at least 51 percent unconditionally owned by an economically disadvantaged Indian tribe or Native Hawaiian Organization, or a publicly owned business having at least 51 percent of its stock unconditionally owned by one of these entities which has its management and daily business controlled by members of an economically disadvantaged Indian tribe or Native Hawaiian Organization, and which meets the requirements of 13 CFR 124. The Contractor shall presume that socially and economically disadvantaged individuals include Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Subcontinent Asian Americans, and other minorities, or any other individual found to be disadvantaged by the Administration pursuant to section 8(a) of the Small Business Act. The Contractor shall presume that socially and economically disadvantaged entities also include Indian Tribes and Native Hawaiian Organizations.

(d) The term "small business concern owned and controlled by women" shall mean a small business concern (1) which is at least 51 percent owned by one or more women, or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women, and (2) whose management and daily business operations are controlled by one or more women; and

(e) Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern, a small business concern owned and controlled by socially and economically disadvantaged individuals or a small business concern owned and controlled by women.

(End of clause)

28. SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (AUG 1996) FAR 52.219-9

NOTE: This clause applies to negotiated solicitations over $1,000,000.00. See also FAR 52.219-9 II below

(a) This clause does not apply to small business concerns.

(b) "Commercial product," as used in this clause, means a product in regular production that is sold in substantial quantities to the general public and/or industry at established catalog or market prices. It also means a product which, in the opinion of the Contracting Officer, differs only insignificantly from the Contractor's commercial product.

"Subcontract," as used in this clause, means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) The offeror, upon request by the Contracting Officer, shall submit and negotiate a subcontracting plan, where applicable, which separately addresses subcontracting with small business concerns, with small disadvantaged business concerns and with women-owned small business concerns. If the offeror is submitting an individual contract plan, the plan must separately address subcontracting with small business concerns, small disadvantaged business concerns, and women-owned small business concerns with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be negotiated within the time specified by the Contracting Officer. Failure to submit and negotiate the subcontracting plan shall make the offeror ineligible for award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business concerns, small disadvantaged business concerns and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

(i) Total dollars planned to be subcontracted;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(iv) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to (i) small business concerns, (ii) small disadvantaged business concerns and (iii) women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the methods used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Automated Source System (PASS) of the Small Business Administration, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, small disadvantaged and women-owned small business concerns trade associations). A firm may rely on the information contained in PASS as an accurate representation of a concern's size and ownership characteristics for purposes of maintaining a small business source list. A firm may rely on PASS as its small business source list. Use of the PASS as its source list does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with (i) small business concerns, (ii) small disadvantaged business concerns, and (iii) women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small, small disadvantaged and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurance that the offeror will include the clause in this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business

concerns) who receive subcontracts in excess of $500,000 ($1,000,000 for construction of any public facility) to adopt a plan similar to the plan agreed to by the offeror.

(10) Assurances that the offeror will (i) cooperate in any studies or surveys as may be required, (ii) submit periodic reports in order to allow the Government to determine the extent of compliance by the offeror with the subcontracting plan, (iii) submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with the instructions on the forms, and (iv) ensure that its subcontractors agree to submit Standard Forms 294 and 295.

(11) A recitation of the types of records the offeror will maintain to demonstrate procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of its efforts to locate small, small disadvantaged and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (e.g., PASS), guides, and other data that identify small, small disadvantaged and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small, small disadvantaged or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than $100,000, indicating (A) whether small business concerns were solicited and if not, why not, (B) whether small disadvantaged business concerns were solicited and if not, why not, (C) whether women-owned small business concerns were solicited and if not, why not, and (D) if applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact (A) trade associations, (B) business development organizations, and (C) conferences and trade fairs to locate small, small disadvantaged and women-owned small business sources.

(v) Records of internal guidance and encouragement provided to buyers through (A) workshops, seminars, training, etc., and (B) monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having company or division-wide annual plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small, small disadvantaged and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the contractor's lists of potential small, small disadvantaged and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small, small disadvantaged and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representative of small, small disadvantaged and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, small disadvantaged or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master subcontracting plan on a plant or division-wide basis which contains all the elements required by (d) above, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided, (1) the master plan has been approved, (2) the offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan,

including evidence of its approval, to the Contracting Officer, and (3) goals and any deviations from the master plan deemed necessary by the Contacting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g)(1) If a commercial product is offered, the subcontracting plan required by this clause may relate to the offeror's production generally, for both commercial and non-commercial products, rather than solely to the Government contract. In these cases, the offeror shall, with the concurrence of the Contracting Officer, submit one company-wide or division-wide annual plan.

(2) The annual plan shall be reviewed for approval by the agency awarding the offeror its first prime contract requiring a subcontracting plan during the fiscal year, or by an agency satisfactory to the Contracting Officer.

(3) The approved plan shall remain in effect during the offeror's fiscal year for all of the offeror's commercial products.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with (1) the clause of this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns," or (2) an approved plan required by this clause, shall be a material breach of the contract.

(End of clause)

29. SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (AUG 1996) ALTERNATE I (OCT 1995) FAR 52.219-9 I

NOTE: This clause applies only to sealed-bid solicitations over $1,000,000.00.

(a) This clause does not apply to small business concerns.

(b) "Commercial product," as used in this clause, means a product in regular production that is sold in substantial quantities to the general public and/or industry at established catalog or market prices. It also means a product which, in the opinion of the Contracting Officer, differs only insignificantly from the Contractor's commercial product.

"Subcontract," as used in this clause, means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) The apparent low bidder, upon request by the Contracting Officer, shall submit a subcontracting plan, where applicable, which separately addresses subcontracting with small business concerns, with small disadvantaged business concerns and with women-owned small business concerns. If the bidder is submitting an individual contract plan, the plan must separately address subcontracting with small business concerns, small disadvantaged business concerns, and women-owned small business concerns, with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be submitted within the time specified by the Contracting Officer. Failure to submit the subcontracting plan shall make the bidder ineligible for the award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business concerns, small disadvantaged business concerns and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

(i) Total dollars planned to be subcontracted;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(iv) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to (i) small business concerns, (ii) small disadvantaged business concerns and (iii) women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the methods used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Automated Source System (PASS) of the Small Business Administration, the National Minority Purchasing Council Vendor Information Service, the Research Information Division of the Minority Business Development Agency in the Department of Commerce, or small, small disadvantaged and women-owned small business concerns trade associations). A firm may rely on the information contained in PASS as an accurate representation of a concern's size and ownership characteristics for purposes of maintaining a small business source list. A firm may rely on PASS as its small business source list. Use of the PASS as its source list does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with (i) small business concerns, (ii) small disadvantaged business concerns, and (iii) women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small, small disadvantaged and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurance that the offeror will include the clause in this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) who receive subcontracts in excess of $500,000 ($1,000,000 for construction of any public facility) to adopt a plan similar to the plan agreed to by the offeror.

(10) Assurances that the offeror will (i) cooperate in any studies or surveys as may be required, (ii) submit periodic reports in order to allow the Government to determine the extent of compliance by the offeror with the subcontracting plan, (iii) submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with the instructions on the forms, and (iv) ensure that its subcontractors agree to submit Standard Forms 294 and 295.

(11) A recitation of the types of records the offeror will maintain to demonstrate procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of its efforts to locate small, small disadvantaged and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (e.g., PASS), guides, and other data that identify small, small disadvantaged and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small, small disadvantaged or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than $100,000, indicating (A) whether small business concerns were solicited and if not, why not, (B) whether small disadvantaged business concerns were solicited and if not, why not, (C) whether women-owned small

business concerns were solicited and if not, why not, and (D) if applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact (A) trade associations, (B) business development organizations, and (C) conferences and trade fairs to locate small, small disadvantaged and women-owned small business sources.

(v) Records of internal guidance and encouragement provided to buyers through (A) workshops, seminars, training, etc., and (B) monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having company or division-wide annual plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small, small disadvantaged and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the contractor's lists of potential small, small disadvantaged and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small, small disadvantaged and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representative of small, small disadvantaged and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, small disadvantaged or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master subcontracting plan on a plant or division-wide basis which contains all the elements required by (d) above, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided, (1) the master plan has been approved, (2) the offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer, and (3) goals and any deviations from the master plan deemed necessary by the Contacting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g)(1) If a commercial product is offered, the subcontracting plan required by this clause may relate to the offeror's production generally, for both commercial and non-commercial products, rather than solely to the Government contract. In these cases, the offeror shall, with the concurrence of the Contracting Officer, submit one company-wide or division-wide annual plan.

(2) The annual plan shall be reviewed for approval by the agency awarding the offeror its first prime contract requiring a subcontracting plan during the fiscal year, or by an agency satisfactory to the Contracting Officer.

(3) The approved plan shall remain in effect during the offeror's fiscal year for all of the offeror's commercial products.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with (1) the clause of this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns," or (2) an approved plan required by this clause, shall be a material breach of the contract.

(End of clause)

30. SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (AUG 1996) ALTERNATE II (MAR 1996) FAR 52.219-9 II

NOTE: This clause applies only to negotiated solicitations over $1,000,000, when a subcontracting plan is required with the initial proposal as described in Sections 00110 & 00115.

(a) This clause does not apply to small business concerns.

(b) "Commercial product," as used in this clause, means a product in regular production that is sold in substantial quantities to the general public and/or industry at established catalog or market prices. It also means a product which, in the opinion of the Contracting Officer, differs only insignificantly from the Contractor's commercial product.

"Subcontract," as used in this clause, means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) Proposals submitted in response to this solicitation shall include a subcontracting plan, which separately addresses subcontracting with small business concerns, small disadvantaged business concerns and women-owned small business concerns. If the offeror is submitting an individual contract plan, the plan must separately address subcontracting with small business concerns, small disadvantaged business concerns and women-owned small business concerns with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be negotiated within the time specified by the Contracting Officer. Failure to submit and negotiate a subcontracting plan shall make the offeror ineligible for award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business concerns, small disadvantaged business concerns and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

(i) Total dollars planned to be subcontracted;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(iv) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to (i) small business concerns, (ii) small disadvantaged business concerns and (iii) women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the methods used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Automated Source System (PASS) of the Small Business Administration, the National Minority Purchasing Council Vendor Information Service, the Research Information Division of the Minority Business Development Agency in the Department of Commerce, or small, small disadvantaged and women-owned small business concerns trade associations). A firm may rely on the information contained in PASS as an accurate representation of a concern's size and ownership characteristics for purposes of maintaining a small business source list. A firm may rely on PASS as its

small business source list. Use of the PASS as its source list does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with (i) small business concerns, (ii) small disadvantaged business concerns, and (iii) women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small, small disadvantaged and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurance that the offeror will include the clause in this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) who receive subcontracts in excess of $500,000 ($1,000,000 for construction of any public facility) to adopt a plan similar to the plan agreed to by the offeror.

(10) Assurances that the offeror will (i) cooperate in any studies or surveys as may be required, (ii) submit periodic reports in order to allow the Government to determine the extent of compliance by the offeror with the subcontracting plan, (iii) submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with the instructions on the forms, and (iv) ensure that its subcontractors agree to submit Standard Forms 294 and 295.

(11) A recitation of the types of records the offeror will maintain to demonstrate procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of its efforts to locate small, small disadvantaged and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (e.g., PASS), guides, and other data that identify small, small disadvantaged and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small, small disadvantaged or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than $100,000, indicating (A) whether small business concerns were solicited and if not, why not, (B) whether small disadvantaged business concerns were solicited and if not, why not, (C) whether women-owned small business concerns were solicited and if not, why not, and (D) if applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact (A) trade associations, (B) business development organizations, and (C) conferences and trade fairs to locate small, small disadvantaged and women-owned small business sources.

(v) Records of internal guidance and encouragement provided to buyers through (A) workshops, seminars, training, etc., and (B) monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having company or division-wide annual plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small, small disadvantaged and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the contractor's lists of potential small, small

disadvantaged and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small, small disadvantaged and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representative of small, small disadvantaged and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, small disadvantaged or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master subcontracting plan on a plant or division-wide basis which contains all the elements required by (d) above, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided, (1) the master plan has been approved, (2) the offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer, and (3) goals and any deviations from the master plan deemed necessary by the Contacting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g)(1) If a commercial product is offered, the subcontracting plan required by this clause may relate to the offeror's production generally, for both commercial and non-commercial products, rather than solely to the Government contract. In these cases, the offeror shall, with the concurrence of the Contracting Officer, submit one company-wide or division-wide annual plan.

(2) The annual plan shall be reviewed for approval by the agency awarding the offeror its first prime contract requiring a subcontracting plan during the fiscal year, or by an agency satisfactory to the Contracting Officer.

(3) The approved plan shall remain in effect during the offeror's fiscal year for all of the offeror's commercial products.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with (1) the clause of this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns," or (2) an approved plan required by this clause, shall be a material breach of the contract.

(End of clause)

31. LIMITATIONS ON SUBCONTRACTING (DEC 1996) FAR 52.219-14I

NOTE: This clause applies only if the contract, or any portion of the contract is set-aside for small business or set-aside for the 8(a) program.

(a) This clause does not apply to the unrestricted portion of a partial set-aside.

(b) By submission of an offer and execution of a contract, the Offeror/Contractor agrees that in performance of the contract in the case of a contract for--

(1) *Services (except construction)*. At least 50 percent of the cost of contract performance incurred for personnel shall be expended for employees of the concern.

(2) *Supplies (other than procurement from a nonmanufacturer of such supplies)*. The concern shall perform work for at least 50 percent of the cost of manufacturing the supplies, not including the cost of materials.

(3) *General construction*. The concern will perform at least 15 percent of the cost of the contract, not including the cost of materials, with its own employees.

(4) *Construction by special trade contractors*. The concern will perform at least 25 percent of the cost of the contract, not including the cost of materials, with its own employees.

(End of clause)

32. LIQUIDATED DAMAGES--SUBCONTRACTING PLAN (OCT 1995) FAR 52.219-16

(a) "Failure to make a good faith effort to comply with the subcontracting plan", as used in this clause, means a willful or intentional failure to perform in accordance with the requirements of the subcontracting plan approved under the clause in this contract entitled "Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan," or willful or intentional action to frustrate the plan.

(b) If, at contract completion, or in the case of a commercial product plan, at the close of the fiscal year for which the plan is applicable, the Contractor has failed to meet its subcontracting goals and the Contracting Officer decides in accordance with paragraph (c) of this clause that the Contractor failed to make a good faith effort to comply with its subcontracting plan, established in accordance with the clause in this contract entitled "Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan," the Contractor shall pay the Government liquidated damages in an amount stated. The amount of probable damages attributable to the Contractor's failure to comply, shall be an amount equal to the actual dollar amount by which the Contractor failed to achieve each subcontract goal or, in the case of a commercial products plan, that portion of the dollar amount allocable to Government contracts by which the Contractor failed to achieve each subcontract goal.

(c) Before the Contracting Officer makes a final decision that the Contractor has failed to make such good faith effort, the Contracting Officer shall give the Contractor written notice specifying the failure and permitting the Contractor to demonstrate what good faith efforts have been made. Failure to respond to the notice may be taken as an admission that no valid explanation exists. If, after consideration of all pertinent data, the Contracting Officer finds that the Contractor failed to make a good faith effort to comply with the subcontracting plan, the Contracting Officer shall issue a final decision to that effect and require that the Contractor pay the Government liquidated damages as provided in paragraph (b) of this clause.

(d) With respect to commercial product plans; i.e., company-wide or division-wide subcontracting plans approved under paragraph (g) of the clause in this contract entitled "Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan," the Contracting Officer of the agency that originally approved the plan will exercise the functions of the Contracting Officer under this clause on behalf of all agencies that awarded contracts covered by that commercial product plan.

(e) The Contractor shall have the right of appeal, under the clause in this contract entitled, Disputes, from any final decision of the Contracting Officer.

(f) Liquidated damages shall be in addition to any other remedies that the Government may have.

(End of clause)

33. SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (DoD CONTRACTS) (APR 1996) DFARS 252.219-7003

This clause supplements the Federal Acquisition Regulation 52.219-9, Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan, clause of this contract.

(a) *Definitions*.

"Historically black colleges and universities," as used in this clause, means institutions determined by the Secretary of Education to meet the requirements of 34 CFR Section 608.2. The term also means any nonprofit research institution that was an integral part of such a college or university before November 14, 1986.

"Minority institutions," as used in this clause, means institutions meeting the requirement of Section 1046(3) of the Higher Education Act of 1965 (20 U.S.C. 1135d-5(3)). The term also includes Hispanic-serving institutions as defined in Section 316(b)(1) of such Act (20 U.S.C. 1059c(b)(1)).

(b) Except for company or division-wide commercial items subcontracting plans, the term "small disadvantaged business," when used in the FAR 52.219-9 clause, includes historically black colleges and universities and minority institutions, in addition to small disadvantaged business concerns.

(c) Work under the contract or its subcontracts shall be credited toward meeting the small disadvantaged business concern goal required by paragraph (d) of the FAR 52.219-9 clause when:

(1) It is performed on Indian lands or in joint venture with an Indian tribe or a tribally-owned corporation, and

(2) It meets the requirements of 10 U.S.C. 2323a.

(d) Subcontracts awarded to workshops approved by the Committee for Purchase from People Who are Blind or Severely Disabled (41 U.S.C. 46-48), may be counted toward the Contractor's small business subcontracting goal.

(e) A mentor firm, under the Pilot Mentor-Protégé Program established under Section 831 of Pub. L. 101-510, as amended, may count toward its small disadvantaged business goal, subcontracts awarded--

(1) Protégé firms which are qualified organizations employing the severely handicapped; and

(2) Former protégé firms that meet the criteria in Section 831(g)(4) of Pub. L. 101-510.

(f) The master plan approval referred to in paragraph (f) of the FAR 52.219-9 clause is approval by the Contractor's cognizant contract administration activity.

(g) In those subcontracting plans which specifically identify small, small disadvantaged, and women-owned small businesses, the Contractor shall notify the Administrative Contracting Officer of any substitutions of firms that are not small, small disadvantaged, or women-owned small businesses for the firms listed in the subcontracting plan. Notifications shall be in writing and shall occur within a reasonable period of time after award of the subcontract. Contractor-specified formats shall be acceptable.

(End of clause)

34. NOTICE TO THE GOVERNMENT OF LABOR DISPUTES (FEB 1997) FAR 52.222-1

If the Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay the timely performance of this contract, the Contractor shall immediate give notice, including all relevant information, to the Contracting Officer.

(End of clause)

35 CONVICT LABOR (AUG 1996) FAR 52.222-3

The Contractor agrees not to employ in the performance of this contract any person undergoing a sentence of imprisonment which has been imposed by any court of a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands. This limitation, however, shall not prohibit the employment by the Contractor in the performance of this contract of persons on parole or probation to work at paid employment during the term of their sentence or persons who have been pardoned or who have served their terms. Nor shall it prohibit the employment by the Contractor in the performance of this contract of persons confined for violation of the laws of any of the States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands who are authorized to work at paid employment in the community under the laws of such jurisdiction, if--

(a) (1) The worker is paid or is in an approved work training program on a voluntary basis;

(2) Representatives of local union central bodies or similar labor union organizations have been consulted;

(3) Such paid employment will not result in the displacement of employed workers, or be applied in skills, crafts, or trades in which there is a surplus of available gainful labor in the locality, or impair existing contracts for services;

(4) The rates of pay and other conditions of employment will not be less than those paid or provided for work of a similar nature in the locality in which the work is being performed; and

(b) The Attorney General of the United States has certified that the work-release laws or regulations of the jurisdiction involved are in conformity with the requirements of Executive Order 11755, as amended by Executive Orders 12608 and 12943.

(End of clause)

36. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT--OVERTIME COMPENSATION (JUL 1995) FAR 52.222-4

(a) *Overtime requirements*. No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics (see Federal Acquisition Regulation (FAR) 22.300) shall require or permit any such laborers or mechanics in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than 1-1/2 times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(b) *Violation; liability for unpaid wages; liquidated damages*. In the event of any violation of the provisions set forth in paragraph (a) of this clause, the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanical employed in violation of the provisions set forth in paragraph (a) of this clause in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by provisions set forth in paragraph (a) of this clause.

(c) *Withholding for unpaid wages and liquidated damages*. The Contracting Officer shall upon his or her own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same Prime Contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act which is held by the same Prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the provisions set forth in paragraph (b) of this clause.

(d) *Payrolls and basic records*. (1) The Contractor or subcontractor shall maintain payrolls and basic payroll records during the course of contract work and shall preserve them for a period of 3 years from the completion of the contract for all laborers and mechanics working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Nothing in this paragraph shall require the duplication of records required to be maintained for construction work by Department of Labor regulations at 29 CFR 5.5(a)(3) implementing the Davis-Bacon Act.

(2) The records to be maintained under paragraph (d)(1) of this clause shall be made available by the Contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit such representatives to interview employees during working hours on the job.

(e) *Subcontracts*. The Contractor or subcontractor shall insert in any subcontracts exceeding $100,000 the provisions set forth in paragraphs (a) through (e) of this clause and also a clause requiring the subcontractors to include these provisions in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the provisions set forth in paragraphs (a) through (e) of this clause.

(End of clause)

37. DAVIS-BACON ACT (FEB 1995) FAR 52.222-6

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (d) of this clause; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b)(1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Contracting Officer shall approved an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination.

(ii) The classification is utilized in the area by the construction industry.

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate

(including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (b)(2) and (b)(3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(d) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(End of clause)

38. WITHHOLDING OF FUNDS (FEB 1988) FAR 52.222-7

The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(End of clause)

39. PAYROLLS AND BASIC RECORDS (FEB 1988) FAR 52.222-8

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits

is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b)(1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents. U.S. Government Printing Office, Washington, DC 20402. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify--

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this clause and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(End of clause)

40. APPRENTICES AND TRAINEES (FEB 1988) FAR 52.222-9

(a) *Apprentices*. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an

apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rates) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) *Trainees*. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(c) *Equal employment opportunity*. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(End of clause)

41. COMPLIANCE WITH COPELAND ACT REQUIREMENTS (FEB 1988) FAR 52.222-10

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(End of clause)

42. SUBCONTRACTS (LABOR STANDARDS) (FEB 1988) FAR 52.222-11

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled *Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination--Debarment, Disputes Concerning Labor Standards, Compliance with Davis-Bacon and Related Act Regulations, and Certification of Eligibility,* and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b)(1) Within 14 days after award of the contract, the Contractor shall delivery to the Contracting Officer a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (a) of this clause have been included in the subcontract.

(2) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall delivery to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

(End of clause)

43. CONTRACT TERMINATION--DEBARMENT (FEB 1988) FAR 52.222-12

A breach of the contract clauses entitled *Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations, or Certification of Eligibility*, may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

(End of clause)

44. COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS (FEB 1988) FAR 52.222-13

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are hereby incorporated by reference in this contract.

(End of clause)

45. DISPUTES CONCERNING LABOR STANDARDS (FEB 1988) FAR 52.222-14

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(End of clause)

46. CERTIFICATION OF ELIGIBILITY (FEB 1988) FAR 52.222-15

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(End of clause)

47. EQUAL OPPORTUNITY (APR 1984) FAR 52.222-26

(a) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of $10,000, the Contractor shall comply with subparagraphs (b)(1) through (11) below. Upon request, the Contractor all provide information necessary to determine the applicability of this clause.

(b) During performing this contract, the Contractor agrees as follows:

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to, (i) employment, (ii) upgrading, (iii) demotion, (iv) transfer, (v) recruitment or recruitment advertising, (vi) layoff or termination, (vii) rates of pay or other forms of compensation, and (viii) selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisement for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(5) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(7) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of labor. Standard Form 100 (EEO-1), or any successor form, is the prescribed form to be filed within 30 days following the award, unless filed within 12 months preceding the date of award.

(8) The Contractor shall permit access to its books, records, and accounts by the contracting agency or the Office of Federal Contract Compliance Programs (OFCCP) for the purposes of investigation to ascertain the Contractor's compliance with the applicable rules, regulations, and orders.

(9) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended, the rules, regulations, and orders of the Secretary of Labor, or as otherwise provided by law.

(10) The Contractor shall include the terms and conditions of subparagraph (b)(1) through (11) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontract or vendor.

(11) The Contractor shall take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(c) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures in 41 CFR 60-1.1.

(End of clause)

48. AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION (APR 1984) FAR 52.222-27

(a) *Definitions*.

"Covered area," as used in this clause, means the geographical area described in the solicitation for this contract.

"Director," as used in this clause, means Director, Office of Federal Contract Compliance Programs (OFCCP), United States Department of Labor, or any person to whom the Director delegates authority.

"Employer identification number," as used in this clause, means the Federal Social Security number used on the employer's quarterly federal tax return, U.S. Treasury Department For 941.

"Minority," as used in this clause, means--

(1) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(3) Black (all persons having origins in any of the black African racial groups not of Hispanic origin);

(4) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race);

(b) If the Contractor, or a subcontractor at any tier, subcontracts a portion of the work involving any construction trade, each such subcontract in excess of $10,000 shall include this clause and the Notice containing the goals for minority and female participation stated in the solicitation for this contract.

(c) If the Contractor is participating in a Hometown Plan (41 CFR 60-4) approved by the U.S. Department of Labor in a covered area, either individually or through an association, its affirmative action obligations on all work in the plan area (including goals) shall comply with the plan for those trades that have unions participating in the plan. Contractors must be able to demonstrate participation in, and compliance with, the provisions of the plan. Each Contractor or subcontractor participating in an approved plan is also required to comply with its obligations under the Equal Opportunity clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good-faith performance by other Contractors or subcontractors toward a goal in an approved plan does not excuse any Contractor's or subcontractor's failure to make good-faith efforts to achieve the plan's goals.

(d) The Contractor shall implement the affirmative action procedures in subparagraphs (g)(1) through (16) of this clause. The goals stated in the solicitation for this contract are expressed as percentages of the total hours of employment and training of minority and female utilization that the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. If

the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical area where that work is actually performed. The Contractor is expected to make substantially uniform progress toward its goals in each craft.

(e) Neither the terms and conditions of any collective bargaining agreement, nor the failure by a union with which the Contractor has a collective bargaining agreement, to refer minorities or women shall excuse the Contractor's obligations under this clause, Executive Order 11246, as amended, or the regulations thereunder.

(f) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(g) The Contractor shall take affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with this clause shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and implement affirmative action steps at least as extensive as the following:

(1) Ensure a working environment free of harassment, intimidation, and coercion at all sites and in all facilities where the Contractor's employees are assigned to work. The Contractor, if possible, will assign two or more women to each construction project. The Contractor shall ensure that foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at these sites or facilities.

(2) Establish and maintain a current list of sources for minority and female recruitment. Provide written notification to minority and female recruitment sources and community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

(3) Establish and maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant, referrals of minorities or females from unions, recruitment sources, or community organizations and the action taken with respect to each individual. If an individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union or, if referred back, not employed by the Contractor, this shall be documented in the file, along with whatever additional actions the Contractor may have taken.

(4) Immediately notify the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred back to the Contractor a minority or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

(5) Develop on-the-job training opportunities and/or participate in training programs for the area that expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under subparagraph (g)(2) above.

(6) Disseminate the Contractor's equal employment policy by--

(i) Providing notice of the policy to unions and to training, recruitment, and outreach programs, and requesting their cooperation in assisting the Contractor in meeting its contract obligations;

(ii) Including the policy in any policy manual and in collective bargaining agreements;

(iii) Publicizing the policy in the company newspaper, annual report, etc.;

(iv) Reviewing the policy with all management personnel and with all minority and female employees at least once a year; and

(v) Posting the policy on bulletin boards accessible to employees at each location where construction work is performed.

(7) Review, at least annually, the Contractor's equal employment policy and affirmative action obligations with all employees having responsibility for hiring, assignment, layoff, termination, or other employment decisions. Conduct review of this policy with all onsite supervisory personnel before initiating construction work at a job site. A written record shall be made an maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

(8) Disseminate the Contractor's equal employment policy externally by including it in any advertising in the news media, specifically including minority and female news media. Provide written notification to, and discuss this policy with, other Contractors and subcontractors with which the Contractor does or anticipates doing business.

(9) Direct recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month before the date for acceptance of applications for apprenticeship or training by any recruitment source, send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

(10) Encourage present minority and female employees to recruit minority persons and women. Where reasonable, provide after-school, summer, and vacation employment to minority and female youth both on the site and in other areas of the Contractor's workforce.

(11) Validate all tests and other selection requirements where required under 41 CFR 60-3.

(12) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities. Encourage these employees to seek or to prepare for through appropriate training, etc., opportunities for promotion.

(13) Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the Contractor's obligations under this contract are being carried out.

(14) Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between sexes.

(15) Maintain a record of solicitations for subcontracts for minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

(16) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's equal employment policy and affirmative action obligations.

(h) The Contractor is encouraged to participate in voluntary associations that may assist in fulfilling one or more of the affirmative actions obligations contained in subparagraphs (g)(1) through (16). The efforts of a contractor association, joint contractor-union, contractor-community, or similar group of which the contractor is a member and participate may be asserted as fulfilling one or more of its obligations under subparagraphs (g)(1) through (16), provided the Contractor--

(1) Actively participates in the group;

(2) Makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry;

(3) Ensures that concrete benefits of the program are reflected in the Contractor's minority and female workforce participation;

(4) Make a good-faith effort to meet its individual goals and timetables; and

(5) Can provide access to documentation that demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply is the Contractor's, and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(i) A single goal for minorities and a separate single goal for women shall be established. The Contractor is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of Executive Order 11246, as amended, if a particular group is employed in a substantially disparate manner.

(j) The Contractor shall not use goals or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

(k) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts under Executive Order 11246, as amended.

(l) The Contractor shall carry out such sanctions and penalties for violation of this clause and of the Equal Opportunity clause, including suspension, termination, and cancellation of existing subcontracts, as may be imposed or ordered under Executive Order 11246, as amended, and its implementing regulations, by the OFCCP. Any failure to carry out these sanctions and penalties as ordered shall be a violation of this clause and Executive Order 11246, as amended.

(m) The Contractor in fulfilling its obligations under this clause shall implement affirmative action procedures at least as extensive as those prescribed in paragraph (g) above, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of Executive Order 11246, as amended, the implementing regulations, or this clause, the Director shall take action as prescribed in 41 CFR 60-4.8.

(n) The Contractor shall designate a responsible official to--

(1) Monitor all employment-related activity to ensure that the Contractor's equal employment policy is being carried out;

(2) Submit reports as may be required by the Government; and

(3) Keep records that shall at least include for each employee the name, address, telephone number, construction trade, union affiliation (if any), employee identification number, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, separate records are not required to be maintained.

(o) Nothing contained herein shall be construed as a limitation upon the application of other laws that establish different standards of compliance or upon the requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

(End of clause)

49. AFFIRMATIVE ACTION FOR DISABLED AND VIETNAM ERA VETERANS (APR 1998) FAR 52.222-35

(a) *Definition.* As used in this clause--.

All employment openings includes all positions except executive and top management, those positions that will be filled from within the contractor's organization, and positions lasting 3 days or less. This term includes full-time employment, temporary employment of more than 3 days' duration, and part-time employment.

Appropriate office of the State employment service system, means the local office of the Federal-State national system of public employment offices with assigned responsibility to serve the area where the employment opening is to be filled including the District of Columbia, Guam, the Commonwealth of Puerto Rico, and the Virgin Islands.

Positions that will be filled from within the Contractor's organization means employment openings for which no considered will be given to persons outside the Contractor's organization (including affiliates,

subsidiaries, and parent companies) and includes any openings that the Contractor proposes to fill from regularly established "recall" lists. The exception does not apply to a particular opening once an employee decides to consider applicants outside of its organization.

Veteran of the Vietnam era means a person who--

(1) Served on active duty for a period of more than 180 days, any part of which occurred between August 5, 1964, and May 7, 1975, and was discharged or released therefrom with other than a dishonorable discharge; or

(2) Was discharged or released from active duty for a service-connected disability if any part of such active duty was performed between August 5, 1964, and May 7, 1975.

(b) *General*. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against the individual because the individual is a disabled veteran or a veteran of the Vietnam era. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified disabled veterans and veterans of the Vietnam era without discrimination based upon their disability or veterans' status in all employment practices such as--

(i) Employment;
(ii) Upgrading;
(iii) Demotion or transfer;
(iv) Recruitment;
(v) Advertising;
(vi) Layoff or termination;
(vii) Rates of pay or other forms of compensation; and
(viii) Selection for training, including apprenticeship.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Vietnam Era Veterans' Readjustment Assistance Act of 1972 (the Act), as amended.

(c) *Listing openings*. (1) The Contractor agrees to list all employment openings existing at contract award or occurring during contract performance, at an appropriate office of the State employment service system in the locality where the opening occurs. These openings include those occurring at any Contractor facility, including one not connected with performing this contract. An independent corporate affiliate is exempt from this requirement.

(2) State and local government agencies holding Federal contracts of $10,000 or more shall also list all employment openings with the appropriate office of the State employment service.

(3) The listing of employment openings with the State employment service system is required at least concurrently with using any other recruitment source or effort and involves the obligations of placing a bona fide job order, including accepting referrals of veterans and nonveterans. This listing does not require hiring any particular job applicant or hiring from any particular group of job applicants and is not intended to relieve the Contractor from any requirements of Executive orders or regulations concerning nondiscrimination in employment.

(4) Whenever the Contractor becomes contractually bound to the listing terms of this clause, it shall advise the State employment service system, in each State where it has establishments, of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these terms and has so advised the State system, it need not advise the State system of subsequent contracts. The Contractor may advise the State system when it is no longer bound by this contract clause.

(d) *Applicability*. This clause does not apply to the listing of employment openings which occur and are filled outside the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, and the Virgin Islands.

(e) *Postings*. (1) The Contractor agrees to post employment notices stating (i) the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era, and (ii) the rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. They shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance Programs, Department of Labor (Deputy Assistant Secretary), and provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of the Act, and is committed to take affirmative action to employ, and advance in employment, qualified disabled veterans and veterans of the Vietnam Era.

(f) *Noncompliance*. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(g) *Subcontracts*. The Contractor shall include the terms of this clause in every subcontract or purchase order of $10,000 or more unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.

(End of clause)

50. AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS (APR 1984) FAR 52.222-36

(a) *General*. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against any employee or applicant because of physical or mental handicap. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as--

(i) Employment;
(ii) Upgrading;
(iii) Demotion or transfer;
(iv) Recruitment;
(v) Advertising;
(vi) Layoff or termination;
(vii) Rates of pay or other forms of compensation; and
(viii) Selection for training, including apprenticeship.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Rehabilitation Act of 1973 (29 U.S.C. 793) (the Act), as amended.

(b) *Postings*. (1) The Contractor agrees to post employment notices stating (i) the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped individuals and (ii) the rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. They shall be in a form prescribed by the Director, Office of Federal Contract Compliance Programs, Department of Labor (Director), and provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Act and is committed to take affirmative action to employ, and advance in employment, qualified physically and mentally handicapped individuals.

(e) *Noncompliance*. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(d) *Subcontracts*. The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of $2,500 unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Director to enforce the terms, including action for noncompliance.

(End of clause)

51. EMPLOYMENT REPORTS ON DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA (APR 1998) FAR 52.222-37

(a) Unless the Contractor is a State or local government agency, the contractor shall report at least annually, as required by the Secretary of Labor, on--

(1) The number of disabled veterans and the number of veterans of the Vietnam era in the workplace of the contractor by job category and hiring location; and

(2) The total number of new employees hired during the period covered by the report, and of that total, the number of disabled veterans, and the number of veterans of the Vietnam era.

(b) The above items shall be reported by completing the form entitled "Federal Contractor Veterans' Employment Report VETS-100."

(c) Reports shall be submitted no later than March 31 of each year beginning March 31, 1988.

(d) The employment activity report required by paragraph (a)(2) of this clause shall reflect total hires during the most recent 12-month period as of the ending data selected for the employment profile report required by paragraph (a)(1) of this clause. Contractors may select an ending date: (1) As of the end of any pay period during the period January through March 1 of the year the report is due, or (2) as of December 31, if the contractor has previous written approval from the Equal Employment Opportunity Commission to do so for purposes of submitting the Employer Information Report EEO-1 (Standard Form 100).

(e) The count of veterans reported according to paragraph (a) of this clause shall be based on voluntary disclosure. Each contractor subject to the reporting requirements at 38 U.S.C.4212 shall invite all disabled veterans and veterans of the Vietnam era who wish to benefit under the affirmative action program at 38 U.S.C. 4212 to identify themselves to the contractor. The invitation shall state that the information is voluntarily provided; that the information will be kept confidential; that disclosure or refusal to provide the information will not subject the applicant or employee to any adverse treatment; and that the information will be used only in accordance with the regulations promulgated under 38 U.S.C. 4212.

(f) *Subcontracts*. The Contractor shall include the terms of this clause in every subcontract or purchase order of $10,000 or more unless exempted by rules, regulations, or orders of the Secretary.

(End of clause)

52. CLEAN AIR AND WATER (APR 1984) FAR 52.223-2

(a) "Air Act," as used in this clause, means the Clean Air Act (42 U.S.C. 7401 et seq.).

"Clean air standards," as used in this clause, means--

(1) Any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, work practices, or other requirements contained in, issued under, or otherwise adopted under the Air Act or Executive Order 11738;

(2) An applicable implementation plan as described in section 110(d) of the Air Act (42 U.S.C. 7410(d));

(3) An approved implementation procedure or plan under section 111(c) or section 111(d) of the Air Act (42 U.S.C. 7411(c) or (d)); or

(4) An approved implementation procedure under section 112(d) of the Air Act (42 U.S.C. 7412(d)).

"Clean water standards," as used in this clause, means any enforceable limitation, control, condition, prohibition, standard, or other requirement promulgated under the Water Act or contained in a permit

issued to a discharger by the EPA or by a State under an approved program, as authorized by section 402 of the Water Act (33 U.S.C. 1342), or by local government to ensure compliance with pretreatment regulations as required by section 307 of the Water Act (33 U.S.C. 1317).

"Compliance," as used in this clause, means compliance with--

(1) Clean air or water standards; or

(2) A schedule or plan ordered or approved by a court of competent jurisdiction, the EPA, or an air or water pollution control agency under the requirements of the Air Act or Water Act and related regulations.

"Facility," as used in this clause, means any building, plant, installation, structure, mine, vessel or other floating craft, location, or site of operations, owned, leased, or supervised by a Contractor or subcontractor, used in the performance of a contract or subcontract. When a location or site of operations includes more than one building, plant, installation, or structure, the entire location or site shall be deemed a facility except when the Administrator, or a designee, of the EPA determines that independent facilities are collocated in one geographical area.

"Water Act," as used in this clause, means Clean Water Act (33 U.S.C. 1251 et seq.).

(b) The Contractor agrees--

(1) To comply with the requirements of section 114 of the Clean Air Act (42 U.S.C. 7414) and section 308 of the Clean Water Act (33 U.S.C. 1318) relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in section 114 and section 308 of the Air Act and the Water Act, and all regulations and guidelines issued to implement those acts before the award of this contract;

(2) That no portion of the work required by this prime contract will be performed in a facility listed on the EPA List of Violating Facilities on the date when this contract was awarded unless and until the EPA eliminates the name of the facility from the listing;

(3) To use best efforts to comply with clean air standards and clean water standards at the facility in which the contract is being performed; and

(4) To insert the substance of this clause into any nonexempt subcontract, including this subparagraph (b)(4).

(End of clause)

53. POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION (APR 1998) FAR 52.223-5

(a) Executive Order 12856 of August 3, 1993, requires Federal facilities to comply with the provisions of the Emergency Planning and Community Right-to-know Act of 1986 (EPCRA) (42 U.S.C. 11001-11050) and the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13101-13109).

(b) The Contractor shall provide all information needed by the Federal facility to comply with the emergency planning reporting requirements of Section 302 of EPCRA; the emergency notice requirements of Section 304 of EPCRA; the list of Material Data Safety Sheets required by Section 311 of EPCRA; the emergency and hazardous chemical inventory forms of Section 312 of EPCRA; the toxic chemical release inventory of Section 313 of EPCRA, which includes the reduction and recycling information required by Section 6607 of PPA; and the toxic chemical reduction goals requirements of Section 3-302 of Executive Order 12856.

(End of clause)

54. DRUG-FREE WORKPLACE (JAN 1997) FAR 52.223-6

(a) Definitions. As used in this clause--

“Controlled substance” means a controlled substance in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C. 812) and as further defined in regulation at 21 CFR 1308.11-1308.15.

“Conviction” means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes.

“Criminal drug statute” means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, possession or use of any controlled substance.

“Drug-free workplace” means the site(s) for the performance of work done by the Contractor in connection with a specific contract at which employees of the Contractor are prohibited from engaging in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance.

“Employee” means an employee of a Contractor directly engaged in the performance of work under a Government contract. “Directly engaged” is defined to include all direct cost employees and any other Contractor employee who has other than a minimal impact or involvement in contract performance.

“Individual” means an offeror/contractor that has no more than one employee including the offeror/contractor.

(b) The Contractor, if other than an individual, shall--within 30 days after award (unless a longer period is agreed to in writing for contracts of 30 days or more performance duration), or as soon as possible for contracts of less than 30 days performance duration--

(1) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the Contractor’s workplace and specifying the actions that will be taken against employees for violations of such prohibition;

(2) Establish an ongoing drug-free awareness program to inform such employees about--

(i) The dangers of drug abuse in the workplace;

(ii) The Contractor’s policy of maintaining a drug-free workplace;

(iii) Any available drug counseling, rehabilitation, and employee assistance programs; and

(iv) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;.

(3) Provide all employees engaged in performance of the contract with a copy of the statement required by subparagraph (b)(1) of this clause;

(4) Notify such employees in writing in the statement required by subparagraph (b)(1) of this clause that, as a condition of continued employment on this contract, the employee will--

(i) Abide by the terms of the statement; and

(ii) Notify the employer in writing of the employee’s conviction under a criminal drug statute for a violation occurring in the workplace no later than 5 days after such conviction.

(5) Notify the Contracting Officer in writing within 10 days after receiving notice under subdivision (b)(4)(ii) of this clause, from an employee or otherwise receiving actual notice of such conviction. The notice shall include the position title of the employee;

(6) Within 30 days after receiving notice under subdivision (b)(4)(ii) of this clause of a conviction, take one of the following actions with respect to any employee who is convicted of a drug abuse violation occurring in the workplace:

(i) Taking appropriate personnel action against such employee, up to and including termination; or

(ii) Require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency; and

(7) Make a good faith effort to maintain a drug-free workplace through implementation of subparagraphs (b)(1) through (b)(6) of this clause.

(c) The Contractor, if an individual, agrees by award of the contract or acceptance of a purchase order, not to engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance while performing this contract.

(d) In addition to other remedies available to the Government, the Contractor's failure to comply with the requirements of paragraph (b) or (c) of this clause may, pursuant to FAR 23.506, render the Contractor subject to suspension of contract payments, termination of the contract for default, and suspension or debarment.

(End of clause)

55. OZONE-DEPLETING SUBSTANCES (JUN 1996) FAR 52.223-11

(a) *Definition*. "Ozone-depleting substance", as used in this clause, means any substance designated as Class I by the Environmental Protection Agency (EPA) (40 CFR Part 82), including but not limited to chlorofluorocarbons, halons, carbon tetrachloride, and methyl chloroform; or any substance designated as Class II by EPA (40 CFR Part 82), including but not limited to hydrochlorofluorocarbons.

(b) The Contractor shall label products which contain or are manufactured with ozone-depleting substances in the manner and to the extent required by 42 U.S.C. 7671j (b), (c), and (d) and 40 CFR Part 82, Subpart E, as follows:

> ''WARNING: Contains (or manufactured with, if applicable) ____*_____, a substance(s) which harm(s) public health and environment by destroying ozone in the upper atmosphere."
>
> *The Contractor shall insert the name of the substance(s).

(End of clause)

56. TOXIC CHEMICAL RELEASE REPORTING (OCT 1996) FAR 52.223-14

(a) Unless otherwise exempt, the Contractor , as owner or operator of a facility used in the performance of this contract, shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106). The Contractor shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.

(b) A Contractor owned or operated facility used in the performance of this contract is exempt from the requirement to file an annual Form R if--

(1) The facility does not manufacture, process or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

(2) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023 (b)(1)(A);

(3) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been file with EPA);

(4) The facility does not fall within the Standard Industrial Classification Code (SIC) designations 20 through 39 as set forth in section 19.102 of the Federal Acquisition Regulation (FAR); or

(5) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(c) If the Contractor has certified to an exemption in accordance with one or more of the criteria in paragraph (b) of this clause, and after award of the contract circumstances change so that any one of its owned or operated facilities used in the performance of this contract is no longer exempt--

(1) The Contractor shall notify the Contracting Officer; and

(2) The Contractor as owner or operator of a facility used in the performance of this contract that is no longer exempt, shall (I) submit a Toxic Chemical Release Inventory Form (Form R) on or before July 1 for the prior calendar year during which the facility becomes eligible; and (ii) continue to file the annual Form R for the life of the contract for such facility.

(d) The Contracting Officer may terminate this contract or take other action as appropriate, if the Contractor fails to comply accurately and fully with the EPCRA and PPA toxic chemical release filing and reporting requirements.

(e) Except for acquisitions of commercial items as defined in FAR Part 2, the Contractor shall--

(1) For competitive subcontracts expected to exceed $100,000 (including all options), include a solicitation provision substantially the same as the provision at FAR 52.223-13, Certification of Toxic Chemical Release Reporting; and

(2) Include in any resultant subcontract exceeding $100,000 (including all options), the substance of this clause, except this paragraph (e).

(End of clause)

57. BUY AMERICAN ACT--CONSTRUCTION MATERIALS (JUN 1997) FAR 52.225-5

NOTE: This clause applies only to contracts less than $6,500,000.

(a) *Definitions*. As used in this clause--

The Buy American Act (41 U.S.C. 10) provides that the Government give preference to domestic construction material.

"Components" means those articles, materials, and supplies incorporated directly into construction materials.

"Construction material" means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

"Domestic construction material" means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(2) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

(b) (1) The Buy American Act (41 U.S.C. 10a-10d) requires that only domestic construction material be used in performing this contract, except as provided in paragraphs (b)(2) and (b)(3) of this clause.

(2) This requirement does not apply to the excepted construction material or components listed by the Government as follows: (List will appear in Section H if required.)

(3) Other foreign construction material may be added to the list in paragraph (b)(2) of this clause if the Government determines that--

(i) The cost would be unreasonable (the cost of a particular domestic construction material shall be determined to be unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent, unless the agency head determines a higher percentage to be appropriate);

(ii) The application of he restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(4) The Contractor agrees that only domestic construction material will be used by the Contractor, subcontractors, material men, and suppliers in the performance of this contract, except for foreign construction materials, if any, listed in paragraph (b)(2) of this clause.

(c) *Request for determination*. (1) Contractors requesting to use foreign construction material under paragraph (b)(3) of this clause shall provide adequate information for Government evaluation of the request for a determination regarding the inapplicability of the Buy American Act. Each submission shall include a description of the foreign and domestic construction materials, including unit of measure, quantity, price, time of delivery or availability, location of the construction project, name and address of the proposed contractor, and a detailed justification of the reason for use of foreign materials cited in accordance with paragraph (b)(3) of this clause. A submission based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause. The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(2) If the Government determines after contract award that an exception to the Buy American Act applies, the contract shall be modified to allow use of the foreign construction material, and adequate consideration shall be negotiated. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration shall not be less than the differential established in paragraph (b)(3)(i) of this clause.

(3) If the Government does not determine that an exception of the Buy American Act applies, the use of that particular foreign construction material will be a failure to comply with the Act.

(d) For evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the following information any applicable supporting data based on the survey of suppliers shall be included in the request:

FOREIGN AND DOMESTIC CONSTRUCTION MATERIALS PRICE COMPARISON

Construction material description	Unit of measure	Quantity	Price (dollars) *
Item 1:			
Foreign construction material			
Domestic construction material			
Item 2:			
Foreign construction material			
Domestic construction material			

List name, address, telephone number, and contract for suppliers surveyed. Attach copy of response; if oral, attach summary. Include other applicable supporting information.

*Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued.

This clause applies to the construction work performed under the contract.

(End of clause)

58. RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (OCT 1996) FAR 52.225-11

(a) Unless advance written approval of the Contracting Officer is obtained, the Contractor shall not acquire for use in the performance of this contract, any supplies or services originating from sources within, or that were located in or transported from or through, countries whose products are banned from importation into the United States under regulations of the Office of Foreign Assets Control, Department of the Treasury. Those countries include Cuba, Iran, Iraq, Libya, and North Korea.

(b) The Contractor shall not acquire for use in the performance of this contract any supplies or services from entities controlled by the Government of Iraq.

(c) The Contractor agrees to insert the provisions of this clause, including this paragraph (c), in all subcontracts hereunder.

(End of clause)

59. BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT (JUN 1997) FAR 52.225-15

NOTE: This clause applies only to acquisitions with an acquisition value of $7,311,000 or more.

(a) *Definitions*. As used in the clause--

"Components" means those articles, materials, and supplies incorporate directly into construction materials.

"Construction material" means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and

distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

"Designated country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a designated country (as defined at FAR 25.401), or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

"Domestic construction material" means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the U.S., if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(2) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

"North American Free Trade Agreement (NAFTA) country" means Canada or Mexico.

"NAFTA country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a NAFTA country, or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

(b) (1) The Buy American Act (41 U.S.C. 10a-10d) requires that only domestic construction material be used in performing this contract, except as provided in paragraphs (b)(2), (b)(3), and (b)(4) of this clause.

(2) The Trade Agreements Act and the North American Free Trade Agreement (NAFTA) provide that designated country and NAFTA country construction materials are exempted from application of the Buy American Act.

(3) The requirement in paragraph (b)(1) of this clause does not apply to the excepted construction material or components listed by the Government as follows:
(See Section 00800)

(4) Other foreign construction material may be added to the list in paragraph (b)(3) of this clause if the Government determines that--

(i) The cost would be unreasonable (the cost of a particular domestic construction material shall be determined to be unreasonable when the cost of such material exceeds the cost of foreign material exceeds the cost of foreign material by more than 6 percent, unless the agency head determines a higher percentage to be appropriate);

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(5) The Contractor agrees that only domestic construction materials, NAFTA country construction materials, or designated country construction materials will be used by the Contractor, subcontractors, material men, and suppliers in the performance of this contract, except for foreign construction materials if any, listed in paragraph (b)(3) of this clause.

(c) *Request for* determination. (1) Contractors requesting to use foreign construction material under paragraph (b)(4) of this clause shall provide adequate information for Government evaluation of the request for a determination regarding the inapplicability of the Buy American Act. Each submission shall include a description of the foreign and domestic construction materials, including unit of measure, quantity, price, time of delivery or availability, location of the construction project, name and address of the proposed contractor, and a detailed justification of the reason for use of foreign materials cited in accordance with paragraph (b)(4) of this clause. A submission based on unreasonable cost shall include a reasonable

survey of the market and a completed price comparison table in the format in paragraph (d) of this clause. The price of construction materials shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(2) If the Government determines after contract award that an exception to the Buy American Act applies, the contract shall be modified to allow use of the foreign construction material, and adequate consideration all be negotiated. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration all not be less than the differential established in paragraph (b)(4)(i) of this clause.

(3) If the Government does not determine that an exception to the Buy American Act applies, the use of that particular foreign construction material will be a failure to comply with the Act.

(d) For evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the following information and any applicable supporting data based on the survey of suppliers shall be included in the request:

FOREIGN AND DOMESTIC CONSTRUCTION MATERIALS PRICE COMPARISON

Construction material description	Unit of measure	Quantity	Price (dollars) *
Item 1:			
Foreign construction material			
Domestic construction material			
Item 2:			
Foreign construction material			
Domestic construction material			

List name, address, telephone number, and contract for suppliers surveyed. Attach copy of response; if oral, attach summary. Include other applicable supporting information.

*Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate is issued).

(End of clause)

60. BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT (MAY 1997) ALTERNATE I (MAY 1997) FAR 52.225-15 I

NOTE: This clause applies only to acquisitions with an acquisition value from $6,500,000 to $7,311,000.

(a) *Definitions*. As used in the clause--

"Components" means those articles, materials, and supplies incorporate directly into construction materials.

"Construction material" means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and

distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

"Designated country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a designated country (as defined at FAR 25.401), or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

"Domestic construction material" means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the U.S., if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(2) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

"North American Free Trade Agreement (NAFTA) country" means Canada or Mexico.

"NAFTA country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a NAFTA country, or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

(b) (1) The Buy American Act (41 U.S.C. 10a-10d) requires that only domestic construction material be used in performing this contract, except as provided in paragraphs (b)(2), (b)(3), and (b)(4) of this clause.

(2) The North American Free Trade Agreement (NAFTA) provides that NAFTA construction materials are exempted from application of the Buy American Act.

(3) The requirement in paragraph (b)(1) of this clause does not apply to the excepted construction material or components listed by the Government as follows:
(See Section H)

(4) Other foreign construction material may be added to the list in paragraph (b)(3) of this clause if the Government determines that--

(i) The cost would be unreasonable (the cost of a particular domestic construction material shall be determined to be unreasonable when the cost of such material exceeds the cost of foreign material exceeds the cost of foreign material by more than 6 percent, unless the agency head determines a higher percentage to be appropriate);

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(5) The Contractor agrees that only domestic construction materials, or NAFTA country construction materials, will be used by the Contractor, subcontractors, material men, and suppliers in the performance of this contract, except for foreign construction materials, if any, listed in paragraph (b)(3) of this clause.

(c) *Request for* determination. (1) Contractors requesting to use foreign construction material under paragraph (b)(4) of this clause shall provide adequate information for Government evaluation of the request for a determination regarding the inapplicability of the Buy American Act. Each submission shall include a description of the foreign and domestic construction materials, including unit of measure, quantity, price, time of delivery or availability, location of the construction project, name and address of the proposed contractor, and a detailed justification of the reason for use of foreign materials cited in accordance with paragraph (b)(4) of this clause. A submission based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause.

The price of construction materials shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(2) If the Government determines after contract award that an exception to the Buy American Act applies, the contract shall be modified to allow use of the foreign construction material, and adequate consideration all be negotiated. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration all not be less than the differential established in paragraph (b)(4)(i) of this clause.

(3) If the Government does not determine that an exception to the Buy American Act applies, the use of that particular foreign construction material will be a failure to comply with the Act.

(d) For evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the following information and any applicable supporting data based on the survey of suppliers shall be included in the request:

FOREIGN AND DOMESTIC CONSTRUCTION MATERIALS PRICE COMPARISON

Construction material description	Unit of measure	Quantity	Price (dollars) *
Item 1:			
Foreign construction material			
Domestic construction material			
Item 2:			
Foreign construction material			
Domestic construction material			

List name, address, telephone number, and contract for suppliers surveyed. Attach copy of response; if oral, attach summary. Include other applicable supporting information.

*Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate is issued).

(End of clause)

61. SECONDARY ARAB BOYCOTT OF ISRAEL (JUN 1992) DFARS 252.225-7031

(a) *Definitions*. As used in this clause--

(1) "Foreign person" means any person other than a United States person as defined in Section 16(2) of the Export Administration Act of 1979 (50 U.S.C. App. Sec 2415).

(2) "United States person" is defined in Section 16(2) of the Export Administration Act of 1979 and means any United States resident or national (other than an individual resident outside the United States and employed by other than a United States person), any domestic concern (including any permanent domestic establishment of any foreign concern), and any foreign concern), and any foreign subsidiary or affiliate (including any permanent foreign establishment) of any domestic concern which is controlled in fact by such domestic concern, as determined under regulations of the President.

(b) *Certification*. By submitting this offer, the Offeror, if a foreign person, company or entity, certifies that it--

(1) Does not comply with the Secondary Arab Boycott of Israel; and

(2) Is not taking or knowingly agreeing to take any action, with respect to the Secondary Boycott of Israel of Arab countries, which 50 U.S.C. App. Sec. 2407(a) prohibits a United States person from taking.

(End of clause)

62. UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES (SEP 1996) FAR 52.226-1

(a) For Department of Defense contracts, this clause applies only if the contract includes a subcontracting plan incorporated under the terms of the clause at FAR 52.219-9, Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan. It does not apply to contracts awarded based on a subcontracting plan submitted and approved under paragraph (g) of the clause at 52.219-9.

(b) *Definitions*. As used in this clause:

"Indian" means any person who is a member of any Indian tribe, band, group, pueblo, or community which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs (BIA) in accordance with 25 U.S.C. 1452(c) and any "Native" as defined in the Alaska Native Claims Settlement Act (43 U.S.C. 1601).

"Indian-organization" means the governing body of any Indian tribe or entity established or recognized by the governing body of an Indiana tribe for the purposes of 25 U.S.C., chapter 17.

"Indian-owned economic enterprise" means any Indian-owned (as determined by the Secretary of the Interior) commercial, industrial, or business activity established or organized for the purpose of profit, provided that Indian ownership shall constitute not less than 51 percent of the enterprise.

"Indian tribe" means any Indian tribe, band, group, pueblo, or community, including native villages and native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, which is recognized by the Federal Government as eligible for services from BIA in accordance with 25 U.S.C. 1452(c).

"Interested party" means a prime contractor or an actual or prospective offeror whose direct economic interest would be affected by the award of a subcontract or by the failure to award a subcontract.

(c) The Contractor agrees to use its best efforts to give Indian organizations and Indian-owned economic enterprises (25 U.S.C. 1544) the maximum practicable opportunity to participate in the subcontracts it awards to the fullest extent consistent with efficient performance of its contract.

(1) The Contracting Officer and the Contractor, acting in good faith, may rely on the self-certification of an Indian organization or Indian-owned economic enterprise as to its eligibility, unless an interested party challenges its status or the Contracting Officer has independent reason to question that status. In the event of a challenge to the self-certification of a subcontractor, the Contracting Officer shall refer the matter to the U.S. Department of the Interior, Bureau of Indian Affairs (BIA), Attn: Chief, Division of Contracting and Grants Administration, 1849 C Street, NW, MS-334A-SIB, Washington, DC 20245. The BIA will determine the eligibility and notify the Contracting Officer. The 5 percent incentive payment will not be made within 50 workings days of subcontract award or while a challenge is pending. If a subcontractor is determined to be an ineligible participant, no incentive payment will be made under the Indian Incentive Program.

(2) The Contractor may request an adjustment under the Indian Incentive Program to the following:

(i) The estimated cost of a cost-type contract;

(ii) The target cost of a cost-plus-incentive-fee prime contract;

(iii) The target cost and ceiling price of a fixed price incentive prime contract.

(iv) The price of a firm-fixed-price prime contract.

(3) The amount of the equitable adjustment to the prime contract shall be 5 percent of the estimated cost, target cost, or firm-fixed-price included in the subcontract initially awarded to the Indian organization or Indian-owned economic enterprise.

(4) The Contractor has the burden of proving the amount claimed and must assert its request for an adjustment prior to completion of contract performance.

(d) The Contracting Officer, subject to the terms and conditions of the contract and the availability of funds, shall authorize an incentive payment of 5 percent of the amount paid to the subcontractor. The Contracting Officer shall seek funding in accordance with agency procedures. The Contracting Officer's decision is final and not subject to the Dispute clause of this contract.

(End of clause)

63. AUTHORIZATION AND CONSENT (JUL 1995) FAR 52.227-1

(a) The Government authorizes and consents to all use and manufacture, in performing any contract or any subcontract at any tier, of any invention described in and covered by a United States patent (1) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract or (2) used in machinery, tools, or methods whose use necessarily results from compliance by the Contractor or a subcontractor with (i) specifications or written provisions forming a part of this contract or (ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

(b) The Contractor agrees to include, and require inclusion of, this clause, suitably modified to identify the parties, in all subcontracts at any tier for supplies or services (including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services expected to exceed the simplified acquisition threshold); however, omission of this clause from any subcontract, including those at or below the simplified acquisition threshold, does not affect this authorization and consent.

(End of clause)

64. PATENT INDEMNITY--CONSTRUCTION CONTRACTS (APR 1984) FAR 52.227-4

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and employees against liability, including costs and expenses, for infringement upon any United States patent (except a patent issued upon an application that is now or may hereafter be withheld from issue pursuant to a Secrecy Order under 35 U.S.C. 181) arising out of performing this contract or out of the use or disposal by or for the account of the Government of supplies furnished or work performed under this contract.

(End of clause)

65. RIGHTS IN SHOP DRAWINGS (APR 1966) DFARS 252.227-7033

(a) Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower-tier subcontractor pursuant to a construction contract, showing in detail(i) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(b) This clause, including this paragraph (b), shall be included in all subcontracts hereunder at any tier.

(End of clause)

66. ADDITIONAL BOND SECURITY (OCT 1997) FAR 52.228-2I

The Contractor shall promptly furnish additional security required to protect the Government and persons supplying labor or materials under this contract if--

(a) Any surety upon any bond, or issuing financial institution for other security, furnished with this contract becomes unacceptable to the Government;

(b) Any surety fails to furnish reports on its financial condition as required by the Government;

(c) The contract price is increased so that the penal sum of any bond becomes inadequate in the opinion of the Contracting Officer; or

(d) An irrevocable letter of credit (ILC) used as security will expire before the end of the period of required security. If the Contractor does not furnish an acceptable extension or replacement ILC, or other acceptable substitute, at least 30 days before an ILC's scheduled expiration, the Contracting Officer has the right to immediately draw on the ILC.

(End of clause)

67. INSURANCE--WORK ON A GOVERNMENT INSTALLATION (JAN 1997) FAR 52.228-5

(a) The Contractor shall, at its own expense, provide and maintain during the entire performance of this contract, at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

(b) Before commencing work under this contract, the Contractor shall notify the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribed or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

(c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

(End of clause)

68. PLEDGES OF ASSETS (FEB 1992) FAR 52.228-11

(a) Offerors shall obtain from each person acting as an individual surety on a bid guarantee, a performance bond, or a payment bond--

(1) Pledge of assets; and

(2) Standard Form 28, Affidavit of Individual Surety.

(b) Pledges of assets from each person acting as an individual surety shall be in the form of--

(1) Evidence of an escrow account containing cash, certificates of deposit, commercial or Government securities, or other assets described in FAR 28.203-2 (except see 28.203-2(b)(2) with respect to Government securities held in book entry form) and/or;

(2) A recorded lien on real estate. The offeror will be required to provide--

(i) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice. This title evidence must show fee simple title vested in the surety along with any concurrent owner; whether any real estate taxes are due and payable; and any recorded encumbrances against the property, including the lien filed in favor of the Government as required by FAR 28.203-3(d);

(ii) Evidence of the amount due under any encumbrance shown in the evidence of title;

(iii) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice, as promulgated by the Appraisal Foundation.

(End of clause)

69. PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS (OCT 1995) FAR 52.228-12

In accordance with Section 806(a)(3) of Pub. L. 102-190, as amended by Sections 2091 and 8105 of Pub. L. 103-355, upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requester.

(End of clause)

70. FEDERAL, STATE, AND LOCAL TAXES (JAN 1991) FAR 52.229-3

(a) "Contract date," as used in this clause, means the date set for bid opening or, if this is a negotiated contract or a modification, the effective date of this contract or modification

"All applicable Federal, State, and local taxes and duties," as used in this clause, means all taxes and duties, in effect on the contract date, that the taxing authority is imposing and collecting on the transactions or property covered by this contract.

"After-imposed Federal tax," as used in this clause, means any new or increased Federal excise tax or duty, or tax that was exempted or excluded on the contract date but whose exemption was later revoked or reduced during the contract period, on the transactions or property covered by this contract that the Contractor is required to pay or bear as the result of legislative, judicial, or administrative action taking effect after the contract date. It does not include social security tax or other employment taxes.

"After-relieved Federal tax," as used in this clause, means any amount of Federal excise tax or duty, except social security or other employment taxes, that would otherwise have been payable, on the transactions or property covered by this contract, but which the Contractor is not required to pay or bear, or for which the Contractor obtains a refund or drawback, as the result of legislative, judicial, or administrative action taking effect after the contract date.

(b) The contract price includes all applicable Federal, State, and local taxes and duties.

(c) The contract price shall be increased by the amount of any after-imposed Federal tax, provided the Contractor warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price, as a contingency reserve or otherwise.

(d) The contract price shall be decreased by the amount of any after-relieved Federal tax.

(e) The contract price shall be decreased by the amount of any Federal excise tax or duty, except social security or other employment taxes, that the Contractor is required to pay or bear, or does not obtain a refund of, through the Contractor's fault, negligence, or failure to follow instructions of the Contracting Officer.

(f) No adjustment shall be made in the contract price under this clause unless the amount of the adjustment exceed $250.

(g) The Contractor shall promptly notify the Contracting Officer of all matters relating to any Federal excise tax or duty that reasonably may be expected to result in either an increase or decrease in the contract price and shall take appropriate action as the Contracting Officer directs.

(h) The Government shall, without liability, furnish evidence appropriate to establish exemption from any Federal, State, or local tax when the Contractor requests such evidence and a reasonable basis exists to sustain the exemption.

(End of clause)

71. SUPPLEMENTAL COST PRINCIPLES (DEC 1991) DFARS 52.231-7000

When the allowability of costs under this contract is determined in accordance with Part 31 of the Federal Acquisition Regulation (FAR), allowability shall also be determined in accordance with Part 231 of the Defense FAR Supplement, in effect on the date of this contract.

(End of clause)

72. PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (MAY 1997) FAR 52.232-5

(a) *Payment of price*. The Government shall pay the Contractor the contract price as provided in this contract.

(b) *Progress payments*. The Government shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer.

(1) The Contractor's request for progress payments shall include the following substantiation:

(i) An itemization of the amounts requested, related to the various elements of work required by the contract covered by the payment requested.

(ii) A listing of the amount included for work performed by each subcontractor under the contract.

(iii) A listing of the amount included for work performed by each subcontract under the contract.

(iv) A listing of the amounts previously paid to each such subcontractor under the contract.

(v) Additional supporting data in a form and detail required by the Contracting Officer.

(2) In the preparation of estimates, the Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site also may be taken into consideration if--

(i) Consideration is specifically authorized by this contract; and

(ii) The Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) *Contractor certification*. Along with each request for progress payments, the Contractor shall furnish the following certification, or payment shall not be made: (However, if the Contractor elects to delete paragraph (c)(4) from the certification, the certification is still acceptable.)

I hereby certify, to the best of my knowledge and belief, that--

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of chapter 39 of Title 31, United States Code; and

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract; and

(4) This certification is not to be construed as final acceptance of a subcontractor's performance.

_____

(Name)

_____

(Title)

_____

(Date)

(d) *Refund of unearned amounts*. If the Contractor, after making a certified request for progress payments, discovers that a portion or all of such request constitutes a payment for performance by the Contractor that fails to conform to the specifications, terms, and conditions of this contract (hereinafter referred to as the "unearned amount"), the Contractor shall--

(1) Notify the Contracting Officer of such performance deficiency; and

(2) Be obligated to pay the Government an amount (computed by the Contracting Officer in the manner provided in paragraph (j) of this clause) equal to interest on the unearned amount from the date of receipt of the unearned amount until--

(i) The date the Contractor notifies the Contracting Officer that the performance deficiency has been corrected; or

(ii) The date the Contractor reduces the amount of any subsequent certified request for progress payments by an amount equal to the unearned amount.

(e) *Retainage*. If the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Contracting Officer shall authorize payment to be made in full. However, if satisfactory progress has not been made, the Contracting Officer may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved. When the work is substantially complete, the Contracting Officer may retain from previously withheld funds and future progress payments that amount the Contracting Officer considers adequate for protection of the Government and shall release to the Contractor all the remaining withheld funds. Also, on completion and acceptance of each separate building, public work, or other division of the contract, for which the price is stated separately in the contract, payment shall be made for the completed work without retention of a percentage.

(f) *Title, liability, and reservation of rights*. All material and work covered by progress payments made shall, at the time of payment, become the sole property of the Government, but this shall not be construed as--

(1) Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or

(2) Waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(g) *Reimbursement for bond premiums*. In making these progress payments, the Government shall, upon request, reimburse the Contractor for the amount of premiums paid for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor has furnished evidence of full payment to the surety. The retainage provisions in paragraph (e) of this clause shall not apply to that portion of progress payments attributable to bond premiums.

(h) *Final payment.* The Government shall pay the amount due the Contractor under this contract after--

(1) Completion and acceptance of all work;

(2) Presentation of a properly executed voucher; and

(3) Presentation of release of all claims against the Government arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned under the Assignment of Claims Act of 1940 (31 U.S.C. 3727 and 41 U.S.C. 15).

(i) *Limitation because of undefinitized work.* Notwithstanding any provision of this contract, progress payments shall not exceed 80 percent on work accomplished on undefinitized contract actions. A "contract action" is any action resulting in a contract, as defined in FAR Subpart 2.1, including contract modifications for additional supplies or services, but not including contract modifications that are within the scope and under the terms of the contract, such as contract modifications issued pursuant to the Changes clause, or funding and other administrative changes.

(j) *Interest computation on unearned accounts.* In accordance with 31 U.S.C. 3903(c)(1), the amount payable under subparagraph (d)(2) of this clause shall be--

(1) Computed at the rate of average bond equivalent rates of 91-day Treasury bills auctioned at the most recent auction of such bills prior to the date the Contractor receives the unearned amount; and

(2) Deducted from the next available payment to the Contractor.

(End of clause)

73. INTEREST (JUNE 1996) FAR 52.232-17

(a) Except as otherwise provided in this contract under a Price Reduction for Defective Cost or Pricing Data clause or a Cost Accounting Standards clause, all amounts that become payable by the Contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code (26 U.S.C. 1481)) shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in Section 12 of the Contract Disputes Act of 1978 (Public Law 95-563), which is applicable to the period in which the amount becomes due, as provided in paragraph (b) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid.

(b) Amounts shall be due at the earliest of the following dates:

(1) The date fixed under this contract.

(2) The date of the first written demand for payment consistent with this contract, including any demand resulting from a default termination.

(3) The date the Government transmits to the Contractor a proposed supplemental agreement to confirm completed negotiations establishing the amount of debt.

(4) If this contract provides for revision of prices, the date of written notice to the Contractor stating the amount of refund payable in connection with a pricing proposal or a negotiated pricing agreement not confirmed by contract modification.

(c) The interest charge made under this clause may be reduced under the procedures prescribed in 32.614-2 of the Federal Acquisition Regulation in effect on the date of this contract.

(End of clause)

74. ASSIGNMENT OF CLAIMS (JAN 1986) ALTERNATE I (APR 1984) FAR 52.232-23 I

(a) The Contractor, under the Assignment of Claims Act, as amended, 31 U.S.C. 3727, 41 U.S.C. 15 (hereafter referred to as "the Act"), may assign it rights to be paid amounts due or to become due as a result of the performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency. The assignee under such an assignment may thereafter further assign or reassign its right under the original assignment to any type of financing institution described in the preceding sentence. Unless otherwise stated in this contract, payments to an assignee of any amounts due or to become due under this contract shall not, to the extent specified in the Act, be subject to reduction or setoff.

(b) Any assignment or reassignment authorized under the Act and this clause shall cover all unpaid amounts payable under this contract, and shall not be made to more than one party, except that an assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in the financing of this contract.

(c) The Contractor shall not furnish or disclose to any assignee under this contract any classified document (including this contract) or information related to work under this contract until the Contracting Officer authorizes such action in writing.

(End of clause)

75. PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (JUN 1997) FAR 52.232-27

Notwithstanding any other payment terms in this contract, the Government will make invoice payments and contract financing payments under the terms and conditions specified in this clause. Payment shall be considered as being made on the day a check is dated or an electronic funds transfer. Definitions of pertinent terms are set forth in 32.902 of the Federal Acquisition Regulation. All days referred to in this clause are calendar days, unless otherwise specified. (However, see subparagraph (a)(3) concerning payments due on Saturdays, Sundays, and legal holidays.)

(a) *Invoice Payments*--(1) *Types of invoice payments.* For purposes of this clause, there are several types of invoice payments which may occur under this contract, as follows:

(i) Progress payments, if provided for elsewhere in this contract, based on Contracting Officer approval of the estimated amount and value of work or services performed, including payments for reaching milestones in any project:

(A) The due date for making such payments shall be 14 days after receipt of the payment request by the designated billing office. However, if the designated billing office fails to annotate the payment request with the actual date of receipt at the time of receipt, the payment due date shall be the 14th day after the date of the Contractor's payment request, provided a proper payment request is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) The due date for payment of any amounts retained by the Contracting Officer in accordance with the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts, shall be as specified in the contract or, if not specified 30 days after approval for release to the Contractor by the Contracting Officer.

(ii) Final payments based on completion and acceptance of all work and presentation of release of all claims against the Government arising by virtue of the contract, and payments for partial deliveries that have been accepted by the Government (e.g., each separate building, public work, or other division of the contract for which the price is stated separately in the contract):

(A) The due date for making such payments shall be either the 30th day after receipt by the designated billing office of a proper invoice from the Contractor, or the 30th day after Government acceptance of the work or

services completed by the Contractor, whichever is later. If the designated billing office fails to annotate the invoice with the date of actual receipt at the time of receipt, the invoice payment due date shall be deemed to be the 30th day after the date the Contractor's invoice, provided a proper invoice is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) On a final invoice where the payment amount is subject to contract settlement actions (e.g., release of claims), acceptance shall be deemed to have occurred on the effective date of the contract settlement.

(2) *Contractor's invoice.* The Contractor shall prepare and submit invoices to the designated billing office specified in the contract. A proper invoice must include the items listed in paragraphs (a)(2)(i) through (a)(2)(ix) of this clause. If the invoice does not comply with these requirements, it shall be returned within 7 days after the date the designated billing office received the invoice, with a statement of the reasons why it is not a property invoice. Untimely notification will be taken into account in computing any interest penalty owed the Contractor in the manner described in subparagraph (a)(4) of this clause.

(i) Name and address of the Contractor

(ii) Invoice date. (The Contractor is encouraged to date invoices as close as possible to the date of mailing or transmission.)

(iii) Contract number or other authorization for work or services performed (including order number and contract line item number).

(iv) Description of work or services performed.

(v) Delivery and payment terms (e.g., prompt payment discount terms).

(vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).

(vii) Name (where practicable), title, phone number, and mailing address of person to be notified in event of a defective invoice.

(viii) For payments described in paragraph (a)(1)(i) of this clause, substantiation of the amounts requested and certification in accordance with the requirements of the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts.

(ix) Any other information or documentation required by the contract.

(x) While not required, the Contractor is strongly encouraged to assign an identification number to each invoice.

(3) *Interest penalty.* An interest penalty shall be paid automatically by the designated payment office, without request from the Contractor, if payment is not made by the due date and the conditions listed in subdivisions (a)(3)(i) through (a)(3)(iii) of this clause are met, if applicable. However, when the due date falls on a Saturday, Sunday, or legal holiday when Federal Government offices are closed and Government business is not expected to be conducted, payment will be made on the following business day without incurring a late payment interest penalty.

(i) A proper invoice was received by the designated billing office.

(ii) A receiving report or other Government documentation authorizing payment was processed and there was no disagreement over quantity, quality, Contractor compliance with any contract term or condition, or requested progress payment amount.

(iii) In the case of a final invoice for any balance of funds due the Contractor for work or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(4) *Computing penalty amount.* The interest penalty shall be at the rate established by the Secretary of the Treasury under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) that is in effect on the day after the due date, except where the interest penalty is prescribed by other governmental authority (e.g., tariffs). This rate is referred to as the "Renegotiation Board Interest Rate," and it is

published in the *Federal Register* semiannually on or about January 1 and July 1. The interest penalty shall accrue daily on the invoice principal payment amount approved by the Government until the payment date of such approved principal amount, and will be compounded in 30-day increments inclusive from the first day after the due date through the payment date. That is, interest accrued at the end of any 30-day period will be added to the approved invoice principal payment amount and be subject to interest penalties if not paid in the succeeding 30-day period. If the designated billing office failed to notify the Contractor of a defective invoice within the periods prescribed in subparagraph (a)(2) of this clause, the due date on the corrected invoice will be adjusted by subtracting the number of days taken beyond the prescribed notification of defects period. Any interest penalty owed the Contractor will be based on this adjusted due date. Adjustments will be made by the designated payment office for errors in calculating interest penalties.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor for payments described in subdivision (a)(1)(ii) of this clause, Government acceptance or approval shall be deemed to have occurred constructively on the 7th day after the Contractor has completed the work or services in accordance with the terms and conditions of the contract. In the event that actual acceptance or approval occurs within the constructive acceptance or approval period the determination of an interest penalty shall be based on the actual date of acceptance or approval. Constructive acceptance or constructive approval requirements do not apply if there is a disagreement over quantity, quality, or Contractor compliance with a contract provision. These requirements also do not compel Government officials to accept work or services, approve Contractor estimates, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The following periods of the time will not be included in the determination of an interest penalty:

(A) The period taken to notify the Contractor of defects in invoices submitted to the Government, but this may not exceed 7 days.

(B) The period between the defects notice and resubmission of the corrected invoice by the Contractor.

(C) For incorrect electronic funds transfer (EFT) information, in accordance with the EFT clause of this contract

(iii) Interest penalties will not continue to accrue after the filing of a claim for such penalties under the clause at 52.233-1, Disputes, or for more than 1 year. Interest penalties of less than $1.00 need not be paid.

(iv) Interest penalties are not required on payment delays due to disagreement between the Government and the Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. Claims involving disputes, and any interest that may be payable, will be resolved in accordance with the clause at 52.233-1, Disputes.

(5) *Prompt payment discounts.* An interest penalty shall also be paid automatically by the designated payment office, without request from the Contractor, if a discount for prompt payment is taken improperly. The interest penalty will be calculated on the amount of discount taken for the period beginning with the first day after the end of the discount period through the date when the Contractor is paid.

(6) *Additional interest penalty.* (i) If this contract was awarded on or after October 1, 1989, a penalty amount, calculated in accordance with subdivision (a)(6)(iii) of this clause, shall be paid in addition to the interest penalty amount if the Contractor--

(A) Is owed an interest penalty of $1 or more;

(B) Is not paid the interest penalty within 10 days after the date the invoice amount is paid; and

(C) Makes a written demand to the designated payment office for additional penalty payment, in accordance with subdivision (a)(6)(ii) of this clause, postmarked not later than 40 days after the date the invoice amount is paid.

(ii) (A) Contractors shall support written demands for additional penalty payments with the following data. No additional data shall be required. Contractors shall--

(1) Specifically assert that late payment interest is due under a specific invoice, and request payment of all overdue late payment interest penalty and such additional penalty as may be required;

(2) Attach a copy of the invoice on which the unpaid late payment interest was due; and

(3) State that payment of the principal has been received, including the date of receipt.

(B) Demands may be postmarked on or before the 40th day after payment was made, except that--

(1) If the postmarked is illegible or nonexistent, the demand must have been received and annotated with the date of receipt by the designated payment office on or before the 40th day after payment was made; or

(2) If the postmark is illegible or nonexistent and the designated payment office fails to make the required annotation, the demand's validity will be determined by the date the Contractor has placed on the demand; provided such date is no later than the 40th day after payment was made.

(iii) (A) The additional penalty shall be equal to 100 percent of any original late payment, except--

(1) The additional penalty shall not exceed $5,000;

(2) The additional penalty shall never be less than $25; and

(3) No additional penalty is owed if the amount of the underlying interest penalty is less than $1.

(B) If the interest penalty ceases to accrue in accordance with the limits stated in subdivision (a)(4)(iii) of this clause, the amount of the additional penalty shall be calculated on the amount of interest penalty that would have accrue in the absence of these limits, subject to the overall limits on the additional penalty specified in subdivision (a)(6)(iii)(a) of the clause.

(C) For determining the maximum and minimum additional penalties, the test shall be the interest penalty due on each separate payment made for each separate contract. The maximum and minimum additional penalty shall not be based upon individual invoices unless the invoices are paid separately. Where payments are consolidated for disbursing purposes, the maximum and minimum additional penalty determination shall be made separately for each contract therein.

(D) The additional penalty does not apply to payments regulated by other Government regulations (e.g., payments under utility contracts subject to tariffs and regulation).

(b) *Contract Financing Payments*. (1) *Due dates for recurring financing payments.* If this contract provides for contract financing, requests for payment shall be submitted to the designated billing office as specified in this contract or as directed by the Contracting Officer. Contract financing payment shall be made on the 30th day after receipt of a proper contract financing request by the designated billing office. In the event that an audit or other review of a specific financing request is required to ensure compliance with the terms and conditions of the contract, the designated payment office is not compelled to make payment by the due date specified.

(2) *Due dates for other contract financing.* For advance payments, loans, or other arrangements that do not involve recurring submissions of contract financing requests, payment shall be made in accordance with the corresponding contract terms or as directed by the Contracting Officer.

(3) *Interest penalty not applicable.* Contract financing payments shall not be assessed an interest penalty for payment delays.

(c) *Subcontract clause requirements.* The Contractor shall include in each subcontract for property or services (including a material supplier) for the purpose of performing this contract the following:

(1) *Prompt payment for subcontractors.* A payment clause which obligates the Contractor to pay the subcontractor for satisfactory performance under its subcontract not later than 7 days from receipt of payment out of such amounts as are paid to the Contractor under this contract.

(2) *Interest for subcontractors.* An interest penalty clause which obligates the Contractor to pay to the subcontractor an interest penalty for each payment not made in accordance with the payment clause--

(i) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due to made; and

(ii) Computed at the rate of interest established by the Secretary of the Treasury, and published in the *Federal Register*, for interest payments under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligations to pay an interest penalty.

(3) *Subcontract clause flowdown* A clause requiring each subcontractor to include a payment clause and an interest penalty clause conforming to the standards set forth in subparagraphs (c)(1) and (c)(2) of this clause in each of its subcontracts, and to require each of its subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or supplier.

(d) *Subcontract clause interpretation.* The clauses required by paragraph (c) of this clause shall not be construed to impair the right of Contractor or a subcontractor at any tier to negotiate, and to include in their subcontract, provisions that--

(1) *Retainage permitted.* Permit the Contractor or a subcontractor to retain (without cause) a specified percentage of each progress payment otherwise due to a subcontractor for satisfactory performance under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions agreed to by the parties to the subcontract, giving such recognition as the parties deem appropriate to the ability of a subcontractor to furnish a performance bond and payment bond;

(2) *Withholding permitted.* Permit the Contractor or subcontractor to make a determination that part or all of the subcontractor's request for payment may be withheld in accordance with the subcontract agreement; and

(3) *Withholding requirements.* Permit such withholding without incurring any obligation to pay a late payment penalty if--

(i) A notice conforming to the standards of paragraph (g) of this clause previously has been furnished to the subcontractor; and

(ii) A copy of any notice issued by a Contractor pursuant to subdivision (d)(3)(i) of this clause has been furnished to the Contracting Officer.

(e) *Subcontractor withholding procedures.* If a Contractor, after making a request for payment to the Government but before making a payment to a subcontractor for the subcontractor's performance covered by the payment request, discovers that all or a portion of the payment otherwise due such subcontractor is subject to withholding from the subcontractor in accordance with the subcontract agreement, then the Contractor shall--

(1) *Subcontractor notice.* Furnish to the subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon ascertaining the cause giving rise to a withholding, but prior to the due date for subcontractor payment;

(2) *Contracting Officer notice.* Furnish to the Contracting Officer, as soon as practicable, a copy of the notice furnished to the subcontractor pursuant to subparagraph (e)(1) of this clause;

(3) *Subcontractor progress payment reduction.* Reduce the subcontractor's progress payment by an amount not to exceed the amount specified in the notice of withholding furnished under subparagraph (e)(1) of this clause;

(4) *Subsequent subcontractor payment.* Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency, and--

(i) Make such payment within--

(A) Seven days after correction of the identified subcontract performance deficiency (unless the funds therefor must be recovered from the Government because of a reduction under subdivision (e)(5)(i)) of this clause; or

(B) Seven days after the Contractor recovers such funds from the Government; or

(ii) Incur an obligation to pay a late payment interest penalty computed at the rate of interest established by the Secretary of the Treasury, and published in the *Federal Register*, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty;

(5) *Notice to Contracting Officer.* Notify the Contracting Officer upon--

(i) Reduction of the amount of any subsequent certified application for payment; or

(ii) Payment to the subcontractor of any withheld amounts of a progress payment, specifying--

(A) The amounts withheld under subparagraph (e)(1) of this clause; and

(B) The dates that such withholding began and ended; and

(6) *Interest to Government.* Be obligated to pay to the Government an amount equal to interest on the withheld payments (computed in the manner provided in 31 U.S.C. 3903(c)(1)), from the 8th day after receipt of the withheld amounts from the Government until--

(i) The day the identified subcontractor performance deficiency is corrected; or

(ii) The date that any subsequent payment is reduced under subdivision (e)(5)(i) of this clause.

(f) *Third-party deficiency reports.* (1) *Withholding from subcontractor.* If a Contractor, after making payment to a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor (hereafter referred to as a "second-tier subcontractor") a written notice in accordance with section 2 of the Act of August 24, 1935 (40 U.S.C. 270b, Miller Act), asserting a deficiency in such first-tier subcontractor's performance under the contract for which the Contractor may be ultimately liable, and the Contractor determines that all or a portion of future payments otherwise due such first-tier subcontractor is subject to withholding in accordance with the subcontract agreement, the Contractor may, without incurring an obligation to pay an interest penalty under subparagraph (e)(6) of this clause--

(i) Furnish to the first-tier subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon making such determination; and

(ii) Withhold from the first-tier subcontractor's next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (f)(1)(i) of this clause.

(2) *Subsequent payment or interest charge.* As soon as practicable, but not later than 7 days after receipt of satisfactory written notification that the identified subcontract performance deficiency has been corrected, the Contractor shall (i) Pay the amount withheld under paragraph (f)(1)(ii) of this clause to such first-tier subcontractor; or (ii) Incur an obligation to pay a late payment interest penalty to such first-tier subcontractor computed at the rate of interest established by the Secretary of the Treasury, and published in the *Federal Register*, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(g) *Written notice of subcontractor withholding.* A written notice of any withholding shall be issued to a subcontractor (with a copy to the Contracting Officer of any such notice issued by the Contractor), specifying--

(1) The amount to be withheld;

(2) The specific causes for the withholding under the terms of the subcontract; and

(3) The remedial actions to be taken by the subcontractor in order to receive payment of the amounts withheld.

(h) *Subcontractor payment entitlement.* The Contractor may not request payment from the Government of any amount withheld or retained in accordance with paragraph (d) of this clause until such time as the Contractor has determined and certified to the Contracting Officer that the subcontractor is entitled to the payment of such amount.

(i) *Prime-subcontractor disputes.* A dispute between the Contractor and subcontractor relating to the amount or entitlement of a subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to paragraph (c) of this clause does not constitute a dispute to which the United States is a party. The United States may not be interpleaded in any judicial or administrative proceeding involving such a dispute.

(j) *Preservation of prime-subcontractor rights.* Except as provided in paragraph (i) of this clause, this clause shall not limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or a subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or nonperformance by a subcontractor.

(k) *Non-recourse for prime contractor interest penalty.* The Contractor's obligation to pay an interest penalty to a subcontractor pursuant to the clauses included in a subcontract under paragraph (c) of this clause shall not be construed to be an obligation of the United States for such interest penalty. A cost reimbursement claim may not include any amount for reimbursement of such interest penalty.

(End of clause)

76. PAYMENT BY ELECTRONIC FUNDS TRANSFER (CCR) (JUN 1998)
DFARS 252.232-7009

(a) Method of payment. (1) All payments by the Government under this contract shall be made by electronic funds transfer (EFT), except as provided in paragraph (a)(2) or (b) of this clause. As used in this clause, the term "EFT" refers to the funds transfer and may also include the payment information transfer.

(2) In the event the Government is unable to release one or more payments by EFT, the Contractor agrees to either (i) accept payment by check or some other mutually agreeable method of payment, or (ii) request the Government to extend the payment due date until such time as the Government can make payment by EFT (but see paragraph (e) of this clause).

(b) Alternative contractor certification. If the Contractor certifies in writing, as part of its registration with the Central Contractor Registration (CCR) database that it does not have an account with a financial institution and does not have an authorized payment agent, payment shall be made by check to the remittance address contained in the CCR database. All contractor certifications will expire on January 1, 1999.

(c) Contractor's EFT information. Except as provided in paragraph (b) of this clause, the Government shall make payment to the Contractor using the EFT information contained in the CCR database. In the event that the EFT information changes, the Contractor shall be responsible for providing the updated information to the CCR database.

(d) Mechanisms for EFT payment. The Government may make payment by EFT through either an Automated Clearing House subject to the banking laws of the United States or the Federal Reserve Wire Transfer System.

(e) Suspension of payment. If the Contractor's EFT information in the CCR database is incorrect and the Contractor has not certified under paragraph (b) of this clause, the Government need not make payment to the Contractor under this contract until correct EFT information or certification is entered into the CCR database; and any invoice or contract financing request shall be deemed not to be a proper invoice for the

purpose of prompt payment under this contract. The prompt payment terms of the contract regarding notice of an improper invoice and delays in accrual of interest penalties apply.

(f) Contractor EFT arrangements. If the Contractor has identified multiple payment receiving points (i.e., more than one remittance address or EFT information set) in the CCR database, and the Contractor has not notified the Government of the payment receiving point applicable to this contract, the Government shall make payment to the first payment receiving point (EFT information set or remittance address as applicable) listed in the CCR database.

(g) Liability for uncompleted or erroneous transfers. (1) If an uncompleted or erroneous transfer occurs because the Government failed to use the Contracto5r's EFT information in the correct manner, the Government remains responsible for—

(i) Making a correct payment;

(ii) Paying any prompt payment penalty due; and

(iii) Recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because the Contractor's EFT information was incorrect, or was revised within 30 days of Government release of the EFT payment transaction instruction to the Federal Reserve System, and—

(i) If the funds are no longer under the control of the payment office, the Government is deemed to have made payment and the contractor is responsible for recovery of any erroneously directed funds; or

(ii) If the funds remain under the control of the payment office, the Government shall not make payment, and the provisions of paragraph (e) of this clause shall apply.

(h) EFT and prompt payment. A payment shall be deemed to have been made in a timely manner in accordance with the prompt payment terms of this contract if, in the EFT payment transaction instruction released to the Federal Reserve System, the date specified for settlement of the payment is on or before the prompt payment due date, provided the specified payment date is a valid date under the rules of the Federal Reserve System.

(i) EFT and assignment of claims. If the Contractor assigns the proceeds of this contract as provided for in the assignment of claims terms of this contract, the Contractor shall require as a condition of any such assignment, that the assignee register in the CCR database and be paid by EFT in accordance with the terms of this clause. In all respects, the requirements of this clause shall apply to the assignee as if it were the Contractor. EFT information that shows the ultimate recipient of the transfer to be other than the Contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of paragraph (e) of this clause.

(j) Liability for change of EFT information by financial agent. The Government is not liable for errors resulting from changes to EFT information made by the Contractor's financial agent.

(k) Payment information. The payment or disbursing office shall forward to the Contractor available payment information that is suitable for transmission as of the date of release of the EFT instruction to the Federal Reserve System. The Government may request the Contractor to designate a desired format and method(s) for delivery of payment information from a list of formats and methods the payment office is capable of executing. However, the Government does not guarantee that any particular format or method of delivery is available at any particular payment office and retains the latitude to use the format and delivery method most convenient to the Government. If the Contractor has certified in accordance with paragraph (b) of this clause or if the Government otherwise make payment by check in accordance with paragraph (a) of this clause, the Government shall mail the payment information to the remittance address contained in the CCR database.

(End of clause)

77. REDUCTION OR SUSPENSION OF CONTRACT PAYMENTS UPON FINDING OF FRAUD (AUG 1992) DFARS 252.232-7006

(a) 10 U.S.C. 2307(e) permits the head of the agency to reduce or suspend further payments to the Contractor upon a written determination by the agency head that substantial evidence exists that the Contractor's request for advance, partial, or progress payments is based on fraud. The provisions of 10 U.S.C. 2307(e) are in addition to any other rights or remedies provided the Government by law or under contract.

(b) Actions taken by the Government in accordance with 10 U.S.C. 2307(e) shall not constitute an excusable delay under the Default clause of this contract or otherwise relieve the Contractor of its obligations to perform under this contract.

(End of clause)

78. DISPUTES (OCT 1995) FAR 52.233-1

(a) This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613).

(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.

(c) "Claim," as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. A claim arising under a contract, unlike a claim relating to that contract, is a claim that can be resolved under a contract clause that provides for the relief sought by the claimant. However, a written demand or written assertion by the Contractor seeking the payment of money exceeding $100,000 is not a claim under the Act until certified as required by subparagraph (d)(2) of this clause. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(d)(1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer.

(2)(i) Contractors shall provide the certification specified in subparagraph (d)(2)(iii) of this clause when submitting any claim--

(A) Exceeding $100,000; or

(B) Regardless of the amount claimed, when using--

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

(ii) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

(iii) The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor."

(3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.

(e) For Contractor claims of $100,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over $100,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.

(f) The Contracting Officer's decision shall be final unless the Contractor appeals or files a suit as provided in the Act.

(g) If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use ADR. If the Contractor refuses an offer for alternative disputes resolution, the Contractor shall inform the Contracting Officer, in writing, of the Contractor's specific reasons for rejecting the request. When using arbitration conducted pursuant to 5 U.S.C. 575-580, or when using any other ADR technique that the agency elects to handle in accordance with the ADRA, any claim, regardless of amount, shall be accompanied by the certification described in subparagraph (d)(2)(iii) of this clause, and executed in accordance with subparagraph (d)(3) of this clause.

(h) The government shall pay interest on the amount found due and unpaid from (1) the date that the Contracting Officer receives the claim (certified, if required); or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certification, as defined in FAR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claim shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

(i) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under the contract, and comply with any decision of the Contracting Officer.

(End of clause)

79. PROTEST AFTER AWARD (AUG 1996) FAR 52.233-3

(a) Upon receipt of a notice of protest (as defined in FAR 33.101) or a determination that a protest is likely (see FAR 33.102(d)), the Contracting Officer may, by written order to the Contractor, direct the Contractor to stop performance of the work called for by this contract. The order shall be specifically identified as a stop-work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage. Upon receipt of the final decision in the protest, the Contracting Officer shall either--

(1) Cancel the stop-work order; or

(2) Terminate the work covered by the order as provided in the Default, or the Termination for Convenience of the Government, clause of this contract.

(b) If a stop-work order issued under this clause is canceled either before or after a final decision in the protest, the Contractor shall resume work. The Contracting Officer shall make an equitable adjustment in the delivery schedule or contract price, or both, and the contract shall be modified, in writing, accordingly, if--

(1) The stop-work order results in an increase in the time required for, or in the Contractor's cost properly allocable to, the performance of any part of this contract; and

(2) The Contractor asserts its right to an adjustment within 30 days after the end of the period of work stoppage; *provided*, that if the Contracting Officer decides the facts justify the action, the Contracting Officer may receive and act upon a proposal submitted at any time before final payment under this contract.

(c) If a stop-work order is not canceled and the work covered by the order is terminated for the convenience of the Government, the Contracting Officer shall allow reasonable costs resulting from the stop-work order in arriving at the termination settlement.

(d) If a stop-work order is not canceled and the work covered by the order is terminated for default, the Contracting Officer shall allow, by equitable adjustment or otherwise, reasonable costs resulting from the stop-work order.

(e) The Government's rights to terminate this contract at any time are not affected by action taken under this clause.

(f) If, as the result of the Contractor's intentional or negligent misstatement, misrepresentation, or miscertification, a protest related to this contract is sustained, and the Government pays costs, as provided in FAR 33.102(b)(2) or 33.104(h)(1), the Government may require the Contractor to reimburse the Government the amount of such costs. In addition to any other remedy available, and pursuant to the requirements of Subpart 32.6, the Government may collect this debt by offsetting the amount against any payment due the Contractor under any contract between the Contractor and the Government.

(End of clause)

80. DIFFERING SITE CONDITIONS (APR 1984) FAR 52.236-2

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of (1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; *provided*, that the time prescribed in paragraph (a) of this clause for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

(End of clause)

81. SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (APR 1984) FAR 52.236-3

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as to this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Government.

(b) The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any understanding reached or representation made concerning conditions that can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

(End of clause)

82. MATERIAL AND WORKMANSHIP (APR 1984) FAR 52.236-5

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide all information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that to not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

(End of clause)

83. SUPERINTENDENCE BY THE CONTRACTOR (APR 1984) FAR 52.236-6

At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the worksite competent superintendents who are satisfactory to the Contracting Officer and has authority to act for the Contractor.

(End of clause)

84. PERMITS AND RESPONSIBILITIES (NOV 1991) FAR 52.236-7

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

(End of clause)

85. OTHER CONTRACTS (APR 1984) FAR 52.236-8

The Government may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

(End of clause)

86. PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (APR 1984) FAR 52.236-9

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site, and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(End of clause)

87. OPERATIONS AND STORAGE AREAS (APR 1984) FAR 52.236-10

(a) The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

(b) Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

(c) The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(End of clause)

88. USE AND POSSESSION PRIOR TO COMPLETION (APR 1984) FAR 52.236-11

(a) The Government shall have the right to take possession of or use any completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the Government intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the Government has such possession or use, the Contractor shall be relieved of the responsibility for the loss of or damage to the work resulting from the Government's possession or use, notwithstanding the terms of the clause in this contract entitled "Permits and Responsibilities." If prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

(End of clause)

89. CLEANING UP (APR 1984) FAR 52.236-12

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

(End of clause)

90. ACCIDENT PREVENTION (NOV 1991)--ALTERNATE I (NOV 1991) FAR 52.236-13 I

(a) The Contractor shall provide and maintain work environments and procedures which will (1) safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities; (2) avoid interruptions of Government operations and delays in project completion dates; and (3) control costs in the performance of this contract.

(b) For these purposes on contracts for construction or dismantling, demolition, or removal of improvements, the Contractor shall--

(1) Provide appropriate safety barricades, signs, and signal lights;

(2) Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and

(3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.

(c) If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.

(d) Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This notice, when delivered to the

Contractor or the Contractor's representative at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

(e) The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontracts.

(f) Before commencing the work, the Contractor shall--

(1) Submit a written proposed plan for implementing this clause. The plan shall include an analysis of the significant hazards to life, limb, and property inherent in contract work performance and a plan for controlling these hazards; and

(2) Meet with representatives of the Contracting Officer to discuss and develop a mutual understanding relative to administration of the overall safety program.

(End of clause)

91. SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984) FAR 52.236-15

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payment until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately delivery three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

(End of clause)

92. SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997) FAR 52.236-21

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like

effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words “directed”, “required”, “ordered”, “designated”, “prescribed”, or words of like import are used, it shall be understood that the “direction”, “requirement”, “order”, “designation”, or “prescription”, of the Contracting Officer is intended and similarly the words “approved”, “acceptable”, “satisfactory”, or words of like import shall mean “approved by,” or “acceptable to”, or “satisfactory to” the Contracting Officer, unless otherwise expressly stated.

(c) Where “as shown”, “as indicated”, “as detailed”, or words of similar import are used, it shall be understood that reference is made to the drawings accompanying this contract unless stated otherwise. The word “provided” as used herein shall be understood to mean “provide complete in place”, that is furnished and installed”.

(d) Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements and (2) the installation (i.e., fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor’s approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government’s reasons therefor. Any work done before such approval shall be at the Contractor’s risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor.

(End of clause)

93. PRECONSTRUCTION CONFERENCE (FEB 1995) FAR 52.236-26

If the Contracting Officer decides to conduct a preconstruction conference, the successful offeror will be notified and will be required to attend. The Contracting Officer’s notification will include specific details regarding the date, time, and location of the conference, any need for attendance by subcontractors, and information regarding the items to be discussed.

(End of clause)

94. MODIFICATION PROPOSALS--PRICE BREAKDOWN (DEC 1991) DFARS 252.236-7000

(a) The Contractor shall furnish a price breakdown, itemized as required and within the time specified by the Contracting Officer, with any proposal for a contract modification.

(b) The price breakdown--

(1) Must include sufficient detail to permit analysis of profit, and of all costs for--

(i) Material;

(ii) Labor;

(iii) Equipment;

(iv) Subcontracts; and

(v) Overhead; and

(2) Must cover all work involved in the modification, whether the work was deleted, added, or changed.

(c) The Contractor shall provide similar price breakdowns to support any amounts claimed for subcontracts.

(d) The Contractor's proposal shall include a justification for any time extension proposed.

(End of clause)

95. BANKRUPTCY (JUL 1995) FAR 52.242-13

In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the contract, written notification of the bankruptcy to the Contracting Officer responsible for administering the contract. This notification shall be furnished within five days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of Government contract numbers and contracting offices for all Government contracts against which final payment has not been made. This obligation remains in effect until final payment under this contract.

(End of clause)

96. SUSPENSION OF WORK (APR 1984) FAR 52.242-14

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract.

(c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim,

in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

(End of clause)

97. POSTAWARD CONFERENCE (DEC 1991) DFARS 252.242-7000

The Contractor agrees to attend any postaward conference convened by the contracting activity or contract administration office in accordance with Federal Acquisition Regulation Subpart 42.5.

(End of clause)

98. CHANGES (AUG 1987) FAR 52.243-4

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes--

(1) In the specifications (including drawings and designs);
(2) In the method or manner or performance of the work;
(3) In the Government-furnished facilities, equipment, materials, services, or site; or
(4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; *provided*, that the Contractor gives the Contracting Officer written notice stating (1) the date, circumstances, and source of the order and (2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after (1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

(End of clause)

99. PRICING OF CONTRACT MODIFICATIONS (DEC 1991) DFARS 252.243-7001

When costs are a factor in any price adjustment under this contract, the contract cost principles and procedures in FAR Part 31 and DFARS Part 231, in effect on the date of this contract, apply.

(End of clause)

100. CERTIFICATION OF REQUESTS FOR EQUITABLE ADJUSTMENT (JUL 1997) DFARS 252.243-7002

(a) In accordance with 10 U.S.C. 2410(a), any request for equitable adjustment to contract terms that exceeds the simplified acquisition threshold shall bear, at the time of submission, the following certificate executed by an individual authorized to certify the request on behalf of the Contractor:

I certify that the request is made in good faith, and that the supporting data are accurate and complete to the best of my knowledge and belief.

_____
(Official's Name)

_____
(Title)

(b) The certification in paragraph (a) of this clause requires full disclosure of all relevant facts, including--

(1) Cost or pricing data if required in accordance with FAR 15.804-2; and

(2) Actual cost data and data to support any estimated costs, even if cost or pricing data are not required.

(c) The certification requirement in paragraph (a) of this clause does not apply to --

(1) Requests for routine contract payments; for example, requests for payment for accepted supplies and services, routine vouchers under a cost-reimbursement type contract, or progress payment invoices; or

(2) Final adjustments under an incentive provision of the contract.

(d) The amount requested shall accurately reflect the contract adjustment for which the Contractor believes the Government is liable. The request shall include only costs for performing the change, and shall not include any costs that already have been reimbursed or that have been separately claimed. All indirect costs included in the request shall be properly allocable to the change in accordance with applicable acquisition regulations.

(End of clause)

101. SUBCONTRACTS (FIXED-PRICE CONTRACTS) (OCT 1997) FAR 52.244-1

(a) This clause does not apply to firm-fixed-price contracts and fixed-price contracts with economic price adjustment. However, it does apply to subcontracts resulting from unpriced modifications to such contracts.

(b) "Subcontract," as used in this clause, includes but is not limited to purchase orders, and changes and modifications to purchase orders. The Contractor shall notify the Contracting Officer reasonably in advance of entering into any subcontract if the Contractor does not have an approved purchasing system and if the subcontract--

(1) Is proposed to exceed $100,000; or

(2) Is one of a number of subcontracts with a single subcontractor, under this contract, for the same or related supplies or services, that in the aggregate are expected to exceed $100,000.

(c) The advance notification required by paragraph (b) above shall include--

(1) A description of the supplies or services to be subcontracted;

(2) Identification of the type of subcontract to be used;

(3) Identification of the proposed subcontractor and an explanation of why and how the proposed subcontractor was selected, including the competition obtained;

(4) The proposed subcontract price and the Contractor's cost or price analysis;

(5) The subcontractor's current, complete, and accurate cost or pricing data and Certificate of Current Cost or Pricing Data, if required by other contract provisions;

(6) The subcontractor's Disclosure Statement or Certificate relating to Cost Accounting Standards when such data are required by other provisions of this contract; and

(7) A negotiation memorandum reflecting--

(i) The principal elements of the subcontract price negotiations;

(ii) The most significant considerations controlling establishment of initial or revised prices;

(iii) The reason cost or pricing data were or were not required;

(iv) The extent, if any, to which the Contractor did not rely on the subcontractor's cost or pricing data in determining the price objective and in negotiating the final price;

(v) The extent, if any, to which it was recognized in the negotiation that the subcontractor's cost or pricing data were not accurate, complete, or current; the action taken by the Contractor and subcontractor; and the effect of any such defective data on the total price negotiated;

(vi) The reasons for any significant difference between the Contractor's price objective and the price negotiated; and

(vii) A complete explanation of the incentive fee or profit plan when incentives are used. The explanation shall identify each critical performance element, management decisions used to quantify each incentive element, reasons for the incentives, and a summary of all trade-off possibilities considered.

(d) The Contractor shall obtain the Contracting Officer's written consent before placing any subcontract for which advance notification is required under paragraph (b) above. However, the Contracting Officer may ratify in writing any such subcontract. Ratification shall constitute the consent of the Contracting Officer.

(e) Even if the Contractor's purchasing system has been approved, the Contractor shall obtain the Contracting Officer's written consent before placing subcontracts identified below:

_____

_____

(f) Unless the consent or approval specifically provides otherwise, neither consent by the Contracting Officer to any subcontract nor approval of the Contractor's purchasing system shall constitute a determination (1) of the acceptability of any subcontract terms or conditions, (2) of the acceptability of any subcontract price or of any amount paid under any subcontract, or (3) to relieve the Contractor of any responsibility for performing this contract.

(g) No subcontract placed under this contract shall provide for payment on a cost-plus-a-percentage-of-cost basis, and any fee payable under cost-reimbursement subcontracts shall not exceed the fee limitations in subsection 15.404(c)(4)(i) of the Federal Acquisition Regulation (FAR).

(h) The Government reserves the right to review the Contractor's purchasing system as set forth in FAR Subpart 44.3

(End of clause)

102. GOVERNMENT PROPERTY (FIXED-PRICE CONTRACTS) (DEC 1989) FAR 52.245-2

NOTE: This clause applies only when the acquisition cost of all Government-furnished property to be involved in the contract is more than $100,000.

(a) *Government-furnished property*. (1) The Government shall deliver to the Contractor, for use in connection with and under the terms of this contract, the Government-furnished property described in the Schedule or specifications together with any related data and information that the Contractor may request and is reasonably required for the intended use of the property (hereinafter referred to as "Government-furnished property").

(2) The delivery or performance dates for this contract are based upon the expectation that Government-furnished property suitable for use (except for property furnished "as is") will be delivered to the Contractor at the times stated in the Schedule or, if not so stated, in sufficient time to enable the Contractor to meet the contract's delivery or performance dates.

(3) If Government-furnished property is received by the Contractor in a condition not suitable for the intended use, the Contractor shall, upon receipt of it, notify the Contracting Officer, detailing the facts, and, as directed by the Contracting Officer and at Government expense, either repair, modify, return, or otherwise dispose of the property. After completing the directed action and upon written request of the Contractor, the Contracting Officer shall make an equitable adjustment as provided in paragraph (h) of this clause.

(4) If Government-furnished property is not delivered to the Contractor by the required time, the Contracting Officer shall, upon the Contractor's timely written request, make a determination of the delay, if any, caused the Contractor and shall make an equitable adjustment in accordance with paragraph (h) of this clause.

(b) *Changes in Government-furnished property*. (1) The Contracting Officer may, by written notice, (i) decrease the Government-furnished property provided or to be provided under this contract, or (ii) substitute other Government-furnished property for the property to be provided by the Government, or to be acquired by the Contractor for the Government, under this contract. The Contractor shall promptly take such action as the Contracting Officer may direct regarding the removal, shipment, or disposal of the property covered by such notice.

(2) Upon the Contractor's written request, the Contracting Officer shall make an equitable adjustment to the contract in accordance with paragraph (h) of this clause, if the Government has agreed in the Schedule to make the property available for performing this contract and there is any--

(i) Decrease or substitution in this property pursuant to subparagraph (b)(1) above; or

(ii) Withdrawal of authority to use this property, if provided under any other contract or lease.

(c) *Title in Government property*. (1) The Government shall retain title to all Government-furnished property.

(2) All Government-furnished property and all property acquired by the Contractor, title to which vests in the Government under this paragraph (collectively referred to as "Government property"), are subject to the provisions of this clause. However, special tooling accountable to this contract is subject to the provisions of the Special Tooling clause and is not subject to the provisions of this clause. Title to Government property shall not be affected by its incorporation into or attachment to any property not owned by the Government, nor shall Government property become a fixture or lose its identity as personal property by being attached to any real property.

(3) Title to each item of facilities and special test equipment acquired by the Contractor for the Government under this contract shall pass to and vest in the Government when its use in performing this contract commences or when the Government has paid for it, whichever is earlier, whether or not title previously vested in the Government.

(4) If this contract contains a provision directing the Contractor to purchase material for which the Government will reimburse the Contractor as a direct item of cost under this contract--

(i) Title to material purchased from a vendor shall pass to and vest in the Government upon the vendor's delivery of such material; and

(ii) Title to all other material shall pass to and vest in the Government upon--

(A) Issuance of the material for use in contract performance;

(B) Commencement of processing of the material or its use in contract performance; or

(C) Reimbursement of the cost of the material by the Government, whichever occurs first.

(d) *Use of Government property*. The Government property shall be used only for performing this contract, unless otherwise provided in the contract or approved by the Contracting Officer.

(e) *Property administration*. (1) The Contractor shall be responsible and accountable for all Government property provided under this contract and shall comply with Federal Acquisition Regulation (FAR) Subpart 45.5, as in effect on the date of this contract.

(2) The Contractor shall establish and maintain a program for the use, maintenance, repair, protection, and preservation of Government property in accordance with sound industrial practice and the applicable provisions of Subpart 45.5 of the FAR.

(3) If damage occurs to Government property, the risk of which has been assumed by the Government under this contract, the Government shall replace the items or the Contractor shall make such repairs as the Government directs. However, if the Contractor cannot effect such repairs with the time required, the Contractor shall dispose of the property as directed by the Contracting Officer. When any property for which the Government is responsible is replaced or repaired, the Contracting Officer shall make an equitable adjustment in accordance with paragraph (h) of this clause.

(4) The Contractor represents that the contract price does not include any amount for repairs or replacement for which the Government is responsible. Repairs or replacement of property for which the Contractor is responsible shall be accomplished by the Contractor at its own expense.

(f) *Access*. The Government and all its designees shall have access at all reasonable times to the premises in which any Government property is located for the purpose of inspecting the Government property.

(g) *Risk of loss*. Unless otherwise provided in this contract, the Contractor assumes the risk of, and shall be responsible for, any loss or destruction of, or damage to, Government property upon its delivery to the Contractor or upon passage of title to the Government under paragraph (c) of this clause. However, the Contractor is not responsible for reasonable wear and tear to Government property or for Government property properly consumed in performing this contract.

(h) *Equitable adjustment*. When this clause specifies an equitable adjustment, it shall be made to any affected contract provision in accordance with the procedures of the Changes clause. When appropriate, the Contracting Officer may initiate an equitable adjustment in favor of the Government. The right to an equitable adjustment shall be the Contractor's exclusive remedy. The Government shall not be liable to suite for breach of contract for--

(1) Any delay in delivery of Government-furnished property;

(2) Delivery of Government-furnished property in a condition not suitable for its intended use;

(3) A decrease in or substitution of Government-furnished property; or

(4) Failure to repair or replace Government property for which the Government is responsible.

(i) *Final accounting and disposition of Government property* Upon completing this contract, or at such earlier dates as may be fixed by the Contracting Officer, the Contractor shall submit, in a form acceptable to the Contracting Officer, inventory schedules covering all items of Government property (including any resulting scrap) not consumed in performing this contract or delivered to the Government. The Contractor shall prepare for shipment, delivery f.o.b. origin, or dispose of the Government property as may be directed or authorized by the Contracting Officer. The net proceeds of any such disposal shall be credited to the contract price or shall be paid to the Government as the Contracting Officer directs.

(j) *Abandonment and restoration of Contractor's premises*. Unless otherwise provided herein, the Government--

(1) May abandon any Government property in place, at which time all obligations of the Government regarding such abandoned property shall cease; and

(2) Has no obligation to restore or rehabilitate the Contractor's premises under any circumstances (e.g., abandonment, disposition upon completion of need, or upon contract completion). However, if the Government-furnished property (listed in the Schedule or specifications) is withdrawn or is unsuitable for the intended use, or if other Government property is substituted, then the equitable adjustment under paragraph (h) of this clause may properly include restoration or rehabilitation costs.

(k) *Communications*. All communications under this clause shall be in writing.

(l) *Overseas contracts*. If this contract is to be performed outside of the United States of America, its territories, or possessions, the words "Government" and "Government-furnished" (wherever they appear in this clause) shall be construed as "United States Government" and "United States Government-furnished," respectively.

(End of clause)

103. GOVERNMENT-FURNISHED PROPERTY (SHORT FORM) (APR 1984) FAR 52.245-4

NOTE: This clause applies only when the acquisition cost of all Government-furnished property to be involved in the contract is $100,000 or less.

(a) The Government shall delivery to the Contractor, at the time and locations stated in this contract, the Government-furnished property described in the Schedule or specifications. If that property, suitable for its intended used, is not delivered to the Contractor, the Contracting Officer shall equitably adjust affected provisions of this contract in accordance with the Changes clause when--

(1) The Contractor submits a timely written request for an equitable adjustment; and

(2) The facts warrant an equitable adjustment.

(b) Title to Government-furnished property shall remain in the Government. The Contractor shall use the Government-furnished property only in connection with this contract. The Contractor shall maintain adequate property control records in accordance with sound industrial practice and will make such records available for Government inspection at all reasonable times, unless the clause at Federal Acquisition Regulation 52.245-1, Property Records, is included in this contract.

(c) Upon delivery of Government-furnished property to the Contractor, the Contractor assumes, the risk and responsibility for its loss or damage, except--

(1) For reasonable wear and tear;

(2) To the extent property is consumed in performing this contract; or

(3) As otherwise provided for by the provisions of this contract.

(d) Upon completing this contract, the Contractor shall follow the instructions of the Contracting Officer regarding the disposition of all Government-furnished property not consumed in performing this contract or previously delivered to the Government. The Contractor shall prepare for shipment, delivery f.o.b. origin, or dispose of the Government property, as may be directed or authorized by the Contracting Officer. The net proceeds of any such disposal shall be credited to the contract price or shall be paid to the Government as directed by the Contracting Officer.

(e) If this contract is to be performed outside the United States of America, its territories, or possessions, the words "Government" and "Government-furnished" (wherever they appear in this clause) shall be construed as "United States Government" and "United States Government-furnished," respectively.

(End of clause)

104. REPORTS OF GOVERNMENT PROPERTY (MAY 1994) DFARS 252.245-7001

(a) The Contractor shall provide an annual report--

(1) For all DoD property for which the Contractor is accountable under the contract;

(2) Prepared in accordance with the requirements of DD Form 1662, DoD Property in the Custody of Contractors, or approved substitute, including instructions on the reverse side of the form;

(3) In duplicate, to the cognizant Government property administrator, no later than October 31.

(b) The Contractor is responsible for reporting all Government property accountable to this contract, including that at subcontractor and alternate locations.

(End of clause)

105. INSPECTION OF CONSTRUCTION (AUG 1996) FAR 52.246-12

(a) *Definition*. "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government. All work shall be conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) Government inspections and tests are for the sole benefit of the Government and do not--

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;

(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;

(3) Constitute or imply acceptance; or

(4) Affect the continuing rights of the Government after acceptance of the complete work under paragraph (i) below.

(d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.

(e) The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the Government may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

(End of clause)

106. VALUE ENGINEERING--CONSTRUCTION (MAR 1989)--ALTERNATE I (APR 1984) FAR 52.248-3 I

(a) *General*. The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECP's) voluntarily. The Contractor shall share in any instant contract savings realized from accepted VECP's, in accordance with paragraph (f) below.

(b) *Definitions*. "Collateral costs," as used in this clause, means agency costs of operation, maintenance, logistic support, or Government-furnished property.

"Collateral savings," as used in this clause, means those measurable net reductions resulting from a VECP in the agency's overall projected collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, means the estimated reduction in Contractor cost of performance resulting from acceptance of the VECP, minus allowable Contractor's development and implementation costs, including subcontractors' development and implementation costs (see paragraph (h) below).

"Value engineering change proposal (VECP): means a proposal that--

(1) Requires a change to this, the instant contract, to implement; and

(2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics; *provided*, that it does not involve a change--

(i) In deliverable end item quantities only; or

(ii) To the contract type only.

(c) VECP preparation. As a minimum, the Contractor shall include in each VECP the information described in subparagraphs (1) through (7) below. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:

(1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.

(2) A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.

(3) A separate, detailed cost estimate for (i) the affected portions of the existing contract requirement and (ii) the VECP. The cost reduction associated with the VECP shall take into account the

Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (h) below.

(4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.

(5) A predicting of any effects the proposed change would have on collateral costs to the agency.

(6) A statement of the time by which a contract modification accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.

(7) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous Government actions, if known.

(d) *Submission*. The Contractor shall submit VECP's to the Resident Engineer at the worksite, with a copy to the Contracting Officer.

(e) *Government action*. (1) The Contracting Officer shall notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer shall notify the Contractor within the 45-day period and provide the reason for the delay and the expected date of the decisions. The Government will process VECP's expeditiously; however, it shall not be liable for any delay in acting upon a VECP.

(2) If the VECP is not accepted, the Contracting Officer shall notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

(3) Any VECP may be accepted, in whole or in part, by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applies a VECP to this contract, the Contractor shall perform in accordance with the existing contract. The Contracting Officer's decision to accept or reject all or part of any VECP shall be final and not subject to the Disputes clause or otherwise subject to litigation under the Contract Disputes Act of 1978 (41 U.S.C. 601-613).

(f) *Sharing*. (1) *Rates*. The Government's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by (i) 45 percent for fixed-price contracts or (ii) 75 percent for cost-reimbursement contracts.

(2) *Payment*. Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to--

(i) Accept the VECP;

(ii) Reduce the contract price or estimated cost by the amount of instant contract savings; and

(iii) Provide the Contractor's share of savings by adding the amount calculated to the contract price or fee.

(g) *Subcontracts*. The Contractor shall include an appropriate value engineering clause in any subcontract of $50,000 or more an may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) above, the Contractor's allowable development and implementation costs shall include any subcontractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive payments; *provided*, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(h) *Data*. The Contractor may restrict the Government's right to use any part of a VECP or the supporting data by marking the following legend on the affected parts:

"These data, furnished under the Value Engineering--Construction clause of contract _____, shall not be disclosed outside the Government or duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a value engineering change proposal submitted under the clause. This restriction does not limit the Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations."

If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract modification implementing the VECP and shall appropriately mark the data. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

(End of clause)

107. TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (SEP 1996)--ALTERNATE I (SEP 1996) FAR 52.249-2 I

(a) The Government may terminate performance of the work under this contract in whole or in part if the Contracting Officer determines that a termination is in the Government's interest. The Contracting Officer shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination and except as directed by the Contracting Officer, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:

(1) Stop work as specified in the notice.

(2) Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.

(3) Terminate all subcontracts to the extent they relate to the work terminated.

(4) Assign to the Government, as directed by the Contracting Officer, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Government shall have the right to settle or to pay any termination settlement proposal arising out of those terminations.

(5) With approval or ratification to the extent required by the Contracting Officer, settle all outstanding liabilities and termination settlement proposals arising from the termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for purposes of this clause.

(6) As directed by the Contracting Officer, transfer title and delivery to the Government (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Government.

(7) Complete performance of the work not terminated.

(8) Take any action that may be necessary, or that the Contracting Officer may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Government has or may acquire an interest.

(9) Use its best efforts to sell, as directed or authorized by the Contracting Officer, any property of the types referred to in subparagraph (b)(6) of this clause; *provided*, however, that the Contractor (i) is not required to extend credit to any purchaser and (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Contracting Officer. The proceeds of any transfer or disposition will be

applied to reduce any payments to be made by the Government under this contract, credited to the price or cost of the work, or paid in any other manner directed by the Contracting Officer.

(c) The Contractor shall submit complete termination inventory schedules no later than 120 days from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 120-day period.

(d) After expiration of the plant clearance period as defined in Subpart 45.6 of the Federal Acquisition Regulation, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Contracting Officer. The Contractor may request the Government to remove those items or enter into an agreement for their storage. Within 15 days, the Government will accept title to those items and remove them or enter into a storage agreement. The Contracting Officer may verify the list upon removal of the items, or if stored, within 45 days from submission of the list, and shall correct the list, as necessary, before final settlement.

(e) After termination, the Contractor shall submit a final termination settlement proposal to the Contracting Officer in the form and with the certification prescribed by the Contracting Officer. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 1-year period. However, if the Contracting Officer determines that the facts justify it, a termination settlement proposal may be received and acted on after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Contracting Officer may determine, on the basis of information available, the amount, if any due the Contractor because of the termination and shall pay the amount determined.

(f) Subject to paragraph (e) of this clause, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (f) or paragraph (g) of this clause, exclusive of costs shown in subparagraph (g)(3) of this clause, may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be modified, and the Contractor paid the agreed amount. Paragraph (g) of this clause shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(g) If the Contractor and the Contracting Officer fail to agree on the whole amount to be paid because of the termination of work, the Contracting Officer shall pay the Contractor the amounts determined as follows, but without duplication of any amounts agreed upon under paragraph (f) of this clause:

(1) For contract work performed before the effective date of termination, the total (without duplication of any items) of--

(i) The cost of this work;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (g)(1)(i) of this clause; and

(iii) A sum, as profit on subdivision (g)(1)(i) of this clause, determined by the Contracting Officer under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Contracting Officer shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(2) The reasonable costs of settlement of the work terminated, including--

(i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;

(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) Storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(h) Except for normal spoilage, and except to the extent that the Government expressly assumed the risk of loss, the Contracting Officer shall exclude from the amounts payable to the Contractor under paragraph (g) of this clause, the fair value, as determined by the Contracting Officer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Government or to a buyer.

(i) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of this contract, shall govern all costs claimed, agreed to, or determined under this clause.

(j) The Contractor shall have the right of appeal, under the Disputes clause, from any determination made by the Contracting Officer under paragraph (e), (g), or (l) of this clause, except that if the Contractor failed to submit the termination settlement proposal or request for equitable adjustment within the time provided in paragraph (e) or (l), respectively, and failed to request a time extension, there is not right of appeal.

(k) In arriving at the amount due the Contractor under this clause, there shall be deducted--

(1) All unliquidated advance or other payments to the Contractor under the terminated portion of this contract;

(2) Any claim which the Government has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies, or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Government.

(l) If the termination is partial, the Contractor may file a proposal with the Contracting Officer for an equitable adjustment of the price(s) of the continued portion of the contract. The Contracting Officer shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the Contracting Officer.

(m)(1) The Government may, under the terms and conditions it prescribes, make partial payments and payments against costs incurred by the Contractor for the terminated portion of the contract, if the Contracting Officer believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Government upon demand, together with interest computed at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination settlement proposal because of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date determined by the Contracting Officer because of the circumstances.

(n) Unless otherwise provided in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this contract for 3 years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Government, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

(End of clause)

108. DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984) FAR 52.249-10

(a) If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified in this contract including any extension, or fails to complete the work within this time, the Government may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work) that has been delayed. In this event, the government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Government resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Government in completing the work.

(b) The Contractor's right to proceed shall not be terminated nor the Contractor charged with damages under this clause, if--

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include (i) acts of God or of the public enemy, (ii) acts of the Government in either its sovereign or contractual capacity, (iii) acts of another Contractor in the performance of a contract with the Government, (iv) fires, (v) floods, (vi) epidemics, (vii) quarantine restrictions, (viii) strikes, (ix) freight embargoes, (x) unusually severe weather, or (xi) delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within 10 days from the beginning of any delay (unless extended by the Contracting Officer), notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Contracting Officer shall be final and conclusive on the parties, but subject to appeal under the Disputes clause.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Government.

(d) The rights and remedies of the Government in this clause are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

109. COMPUTER GENERATED FORMS (JAN 1991) FAR 52.253-1

(a) Any data required to be submitted on a Standard or Optional Form prescribed by the Federal Acquisition Regulation (FAR) may be submitted on a computer generated version of the form, *provided* the form carries the Standard or Optional Form number and edition data.

(b) Unless prohibited by agency regulations, any data required to be submitted on an agency unique form prescribed by an agency supplement to the FAR may be submitted on a computer generated version of the form provided there is no change to the name, content, or sequence of the data elements on the form and provided the form carries the agency form number and edition data.

(c) If the Contractor submits a computer generated version of a form that is different than the required form, then the rights and obligations of the parties will be determined based on the content of the required form.

(End of clause)

END OF SECTION 00700

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SECTION 00800
SPECIAL CONTRACT REQUIREMENTS

2 January 1996

1. COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK (APR 1984)

FAR 52.211-10. The Contractor shall be required to commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, prosecute said work diligently, and complete the entire work ready for use not later than 1080 calendar days after date of receipt of notice to proceed. The site grading and utilities associated with the Phase IIB portion of the site (see drawings), shall be completed not later than 365 calendar days after receipt of notice to proceed. The time stated for completion shall include as-built drawings, O&M manuals, operational tests/reports/training/instructions, equipment lists, and final cleanup of the premises.

2 January 1996

2. LIQUIDATED DAMAGES--CONSTRUCTION (APR 1984) FAR 52.211-12.

2.1 If the Contractor fails to complete the work within the time specified in the contract (see paragraph 36, SEQUENCE OF WORK), or any extension, the Contractor shall pay to the Government liquidated damages as follows :

(1) For the total contract (1080 days from NTP) $1,660 for each day of delay.
(2) For the sitework portion (365 days form NTP)$1,460 for each day of delay.

2.2 If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.

2.3 If the Government does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

2 January 1996

3. TIME EXTENSIONS (APR 1984) FAR 52.211-13. Notwithstanding any other provisions of this contract, it is mutually understood that the time extensions for changes in the work will depend upon the extent, if

any, by which the changes cause delay in the completion of the various elements of construction. The change order granting the time extension may provide that the contract completion date will be extended only for those specific elements so delayed and that the remaining contract completion dates for all other portions of the work will not be altered and may further provide for an equitable readjustment of liquidated damages under the new completion schedule.

4. and 5. NOT USED.

2 January 1996
(1) 6. CONTRACT DRAWINGS, MAPS AND SPECIFICATIONS (DEC 1991) DFARS 252.236-7001.

6.1 The Government--

(1) Will furnish the Contractor one set of full-sized reproducibles and one compact disk containing Microstation DGN CADD files. Translation of files to other formats will not be provided.

(2) Drawings and specifications are available in the office of the Corps of Engineers, Department of the Army, Room 821, Dr. Martin Luther King, Jr. Place, Louisville, Kentucky.

6.2 The Contractor shall--

(1) Check all drawings furnished immediately upon receipt;

(2) Compare all drawings and verify the figures before laying out the work;

(3) Promptly notify the Contracting Officer of any discrepancies; and

(4) Be responsible for any errors which might have been avoided by complying with paragraph 6.2 (1), (2) and (3).

6.3 Large scale drawings shall, in general, govern small scale drawings. Figures marked on drawings shall, in general, be followed in preference to scale measurements.

6.4 Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work, but shall be performed as if fully and correctly set forth and described in the drawings and specifications.

6.5 The work shall conform to the specifications and the contract drawings dated December 15, 1998 identified on the following index of drawings:

DISCOM Project
Phase I
Ft. Campbell, KY.
P.N. 33901 FY

VOLUME 1: SITE WORK

FILE NAME	SHEET REF.	SHEET NO.	SHEET TITLE
			General

G7_XA010	-	1	Cover
G7_XB010	XB01	2	Project Index of Drawings (Sheet 1 of 3)
G7_XB020	XB02	3	Project Index of Drawings (Sheet 2 of 3)
G7_XB030	XB03	4	Project Index of Drawings (Sheet 3 of 3)
G7_XC010	XC01	5	Volume #1 Index of Drawings
G7_XD010	XD01	6	Location & Vicinity Maps
G7_XE010	XE01	7	Standard Abbreviations
G7_XF010	XF01	8	Standard Symbols
G7_XG010	XG01	9	Borrow/Disposal Area Plan
G7_XG020	XG02	10	Construction Signage and Fencing
G7_XG030	XG03	11	Construction Office and Materials Storage Areas
G7_XG040	XG04	12	Work Limits General
G7_XG050	XG05	13	Work Limits 1 Year After NTP
G7_XG060	XG06	14	Work Limits 2 Years After NTP
			Civil
G7_C0010	C010	15	Civil Legend, General Notes & Abbreviations
G71C0100	C100	16	Demolition Key Map and General Notes
G71C0100A	C100A	17	Demolition Area Site Plan
G71C0101	C101		Not Used
G71C0102	C102	18	Demolition Plan
G71C0103	C103		Not Used
G71C0104	C104	19	Demolition Plan
G71C0105	C105	20	Demolition Plan
G71C0106	C106		Not Used
G71C0106A	C106A		Not Used
G71C0106B	C106B		Not Used
G71C0106C	C106C	21	Demolition Plan
G71C0106D	C106D	22	Demolition Plan
G71C0106E	C106E	23	Demolition Plan
G71C0106F	C106F	24	Demolition Plan
G71C0106G	C106G	25	Demolition Plan
G71C0106H	C106H	26	Demolition Plan
G71C0107	C107	27	Demolition Plan
G71C0108	C108	28	Demolition Plan
G71C0109	C109	29	Demolition Plan
G71C0110	C110	30	Demolition Plan
G71C0111	C111		Not Used
G71C0112	C112	31	Demolition Plan
G71C0113	C113		Not Used
G71C0114	C114	32	Demolition Plan
G71C0115	C115	33	Demolition Plan
G71C0116	C116		Not Used
G71C0117	C117		Not Used
G71C0118	C118	34	Demolition Plan
G71C0119	C119	35	Demolition Plan
G71C0120	C120		Not Used
G71C0121	C121		Not Used
G71C0122	C122	36	Demolition Plan
G71C0123	C123		Not Used
G71C0124	C124		Not Used
G71C0125	C125		Not Used
G71C0126	C126		Not Used
G71C0127	C127	37	Demolition Plan
G71C0200	C200	38	Site Key Map and General Notes

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G71C0206	C206		Not Used
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G71C0206B	C206B		Not Used
G71C0206C	C206C		Not Used
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G7EIF010	EIF01	818	Control Panel "E1" AHU-1/Boiler
G7EIF020	EIF02	819	Control Panel "E1" AHU-1/Boiler
G7EIF030	EIF03	820	Control Panel - AHU (HW/CHW)
G7EIF040	EIF04	821	Control Panel - AHU (HW/CHW)
G7EIF050	EIF05	822	Miscellaneous Control Details

Plumbing

G7EPB01A	EPB01A	823	Plumbing Plan - Soil Waste & Vent
G7EPB01B	EPB01B	824	Plumbing Plan - Water
G7EPC010	EPC01	825	Enlarged Plumbing Plans
G7EPC020	EPC02	826	Plumbing Plan - Waste Pulping System
G7EPD01A	EPD01A	827	Soil Waste & Vent Riser Diagrams
G7EPD01B	EPD01B	828	Soil Waste & Vent Riser Diagram
G7EPD01C	EPD01C	829	Hot & Cold Water Riser Diagram
G7EPD01D	EPD01D	830	Hot & Cold Water Riser Diagram
G7EPF010	EPF01	831	Miscellaneous Plumbing Details
G7EPF020	EPF02	832	Grease Interceptor Details
G7EPF030	EPF03	833	Miscellaneous Plumbing Details

Fire Protection / Sprinkler System

G7EFB010	EFB01	834	Fire Protection Plan
G7EFF010	EFF010	835	Enlarged Sprinkler Plan & Riser Details

Electrical

G7EEA010	EEA01	836	Lighting Fixture Details & Notes
G7EEC010	EEC01	837	Lighting Plan
G7EED010	EED01	838	General Power Plan
G7EED020	EED02	839	HVAC Power Plan
G7EED030	EED03	840	Kitchen Equipment Power Plans
G7EED040	EED04	841	Serving Line Power Plan
G7EED050	EED05	842	Dishwashing Power Plan
G7EED060	EED06	843	Communications Plan

G7EED070	EED07	844	Enlarged Power Plans
G7EEF010	EEF01	845	One Line Diagram
G7EEG010	EEG01	846	One Line Diagram
G7EEG020	EEG02	847	Communication Riser Diagram
G7EEH010	EEH01	848	Electrical Details & Notes
G7EEH020	EEH02	849	Electrical Details & Notes
G7EEH030	FEH03	850	Building "F" Electrical Plan
G7EEJ010	EEJ01	851	Panel Schedules
G7EEJ020	EEJ02	852	Panel Schedules

Life Safety / Fire Protection

G7EDA010	EDA01	853	Life Safety / Fire Protection Code Review
G7EDB010	EDB01	854	Fire Protection / Life Safety Plan

7. NOT USED.

17 JULY 1992

8. RIGHTS IN SHOP DRAWINGS (APR 1966) DFARS 252.227-7033.

8.1 Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower tier subcontractor pursuant to a construction contract, showing detail (I) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

8.2 This clause, including this paragraph (8.2), shall be included in all subcontracts hereunder at any tier.

9. AS-BUILT DRAWINGS.

9.1 During the progress of the job, the Contractor shall keep a careful record at the jobsite of all changes and corrections from the layouts shown on the drawings. The Contractor shall enter such changes and corrections on blue line prints on a weekly basis in accordance with Paragraph 9.1.1 and update the CADD as-built drawings on a monthly basis in accordance with Paragraph 9.1.2. If the Contractor fails to maintain the as-built drawings as required herein, the Contracting Officer will deduct from the monthly progress payment, an amount representing the estimated monthly cost of maintaining the as-built drawings.

9.1.1 The Contractor shall maintain one set of blue line prints marked in red to indicate changes and corrections. The contractor shall mark-up changes and corrections on as-builts promptly to reflect " Current Construction ", but in no case later than on a weekly basis. These ongoing mark-ups will be made available to the Government for review on an as needed basis. Changes must be reflected on all sheets affected by the change. Changes shall include marking the as-built drawings to reflect structural details, foundation layouts, equipment, sizes, mechanical room layouts and other extensions of design, that could not be shown in the original contract documents because the exact details were not known until after the time of approved shop drawings. The Contractor shall provide Current Construction drawings to the Government, no later than 48 hours after they are requested, for use of the Government if needed in the preparation of other construction contracts. The Contractors Quality Control person, on a monthly basis, will review the on-going as-builts and provide a letter submitted with Pay Requests to the Contracting Officer certifying that changes and corrections are up to date.

9.1.2 The Contractor shall be furnished all CADD files on CD-ROM in Bentley Microstation Version 5 or later design format. The Government will furnish documentation which lists these files along with all reference files attached to each. These files will be modified by the Contractor to reflect as-built conditions and returned to the Contracting Officer upon occupancy of the facility by the Government and in the same format and on the same media on which they were supplied. The contractor shall enter changes and corrections on CADD as-built drawings promptly, but in no case later than on a monthly basis. All changes should be made in the appropriate original file and should be placed on the same level as the original drawing entity. The color number of all elements placed or modified by the Contractor shall be 52. Changes made to elements in 3D files shall be placed at their proper location in 3D space. The Contractor shall "Match" the original drawing except as indicated above. The person working on the as-built drawings needs to be qualified and trained in the use of Microstation.

9.1.3 The Contractor shall provide all shop drawings in digital format compatible with Intergraph's RLE raster format or Bentley Microstation Version 5 or later. Both Shop and As-Built drawings shall show all changes and revisions made up to the time the work is completed and accepted and shall reflect any changes, alterations adjustments or modifications resulting from approved shop drawings. Changes must be reflected on all sheets affected by the change. Changes shall include marking the as-built drawings to reflect structural details, foundation layouts, equipment, sizes, mechanical room layouts and other extensions of design, that could not be shown in the original contract documents because the exact details were not known until after the time of approved shop drawings. All Shop and final As-Built drawings which are used by the Contractor to show the as-built condition, shall be provided on 80 pound translucent bond vellum. Title blocks shall be marked as indicated in Fig. 1 for A Current Construction @ drawings and as indicated in Fig. 2 for final "As-Built" drawings. Final payment with respect to separately priced facilities or the contract as a whole, will be withheld until proper as-built drawings have been furnished to and accepted by the Contracting Officer.

9.2 The as-built drawings shall indicate, in addition to all changes and corrections, the actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

9.3 If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, Contractor shall furnish a contour map of the final borrow pit/spoil area elevations as part of the final As-Built drawings and in the same format required in paragraph 9.1.2 above.

9.4 If fire protection and fire detection related systems are included in this project, the as-built drawings will include detailed information for all aspects of the systems including wiring, piping, and equipment drawings.

9.5 For projects where portions of construction are to be occupied or activated prior to overall project completion, including portions of utility systems, as-built drawings for those portions of the facility being occupied or activated shall be supplied at that time. This same as-built information previously furnished must also be shown on the final set of as-built drawings only in cases where it is required to show portions of the project not previously occupied or activated. In addition, for those projects being constructed in phases as identified on the drawings, or in the "Sequence of Work" clause, the as-built drawings shall be completed and submitted as each phase is completed.

9.6 Final "As-Built" drawings shall be provided to the Contracting Officer on CD ROM in accordance with the above no later than 10 working days after final acceptance of the project. Final "As-Built" drawings shall contain all changes and corrections made during construction.

9.7 No separate or direct payment will be made for the work specified herein. All costs associated with this work shall be included in the applicable contract prices for the items requiring "As-Built" drawings listed in the bidding schedule.

1 August 1996
(2) 10. EQUIPMENT DATA.

10.1 Real Property Equipment. The Contractor shall be required to make a list of all installed equipment furnished under this contract. This list shall include all information usually listed on manufacturer's name plate. The RMS form is called INSTALLATION PROPERTY INFORMATION can be found in the RMS software. The list shall also include the cost of each piece of installed property F.O.B. construction site. For each of the items which is specified herein to be guaranteed for a specified period from the date of acceptance thereof, the following information shall be given: The name, serial and model number address of equipment supplier, or manufacturer originating the guaranteed item. The Contractor's guarantee to the Government of these items will not be limited by the terms of any manufacturer's guarantee to the Contractor. The list shall be furnished in electronic format in addition to hard paper copy. The list shall be furnished to the Contracting Officer not later than thirty (30) calendar days prior to completion of any segment of the contract work which has an incremental completion date.

10.2 Maintenance and Parts Data. The Contractor will be required to furnish a brochure, catalog cut, parts list, manufacturer's data sheet or other publication which will show detailed parts data on all other equipment subject to repair and maintenance procedures not otherwise required in Operations and Maintenance Manuals specified elsewhere in this contract. Distribution of directives shall follow the same requirements as listed in paragraph 10.1.

2 January 1996
11. PHYSICAL DATA (APR 1984) FAR 52.236-4. Data and information furnished or referred to below are furnished for the Contractor's information. The Government will not be responsible for any interpretation or conclusion drawn from the data or information by the Contractor.

11.1 Physical Conditions indicated on the drawings and in the specifications are the result of site investigations.

11.2 Weather Conditions. The Contractor shall make his own investigations as to weather conditions at the site. Data may be obtained from various National Weather Service offices located generally at airports of principal cities, the nearest to this project being:

Nashville
NWS Office
2500 Ambrose Dr.
Alcoa, TN 37701
615-970-2784

Historical data for all areas may be obtained from:

U. S. Department of Commerce
National Climatic Center
Federal Building
Asheville, N. C. 28801

11.3 Transportation Facilities. Roads and railroads in the general area are shown on the drawings. Access ways shall be investigated by the Contractor to satisfy himself as to their existence and allowable use.

11.4 Not Used.

15 June 1990
12. UTILITIES (APR 1984) FAR 52.236-14 (Para. 12.1.1 & 12.1.2 only).

12.1 Availability and Use of Utility Services.

12.1.1 The Government will make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

12.1.2 The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

12.1.3 Not Used.

12.2 Alterations to Utilities. Where changes and relocations of utility lines are noted to be performed by others, the Contractor shall give the Contracting Officer at least thirty (30) days written notice in advance of the time that the change or relocation is required. In the event that, after the expiration of thirty (30) days after the receipt of such notice by the Contracting Officer, such utility lines have not been changed or relocated and delay is occasioned to the completion of the work under contract, the Contractor will be entitled to a time extension equal to the period of time lost by the Contractor after the expiration of said thirty (30) day period. Any modification to existing or relocated lines required as a result of the Contractor's method of operation shall be made wholly at the Contractor's expense and no additional time will be allowed for delays incurred by such modifications.

12.3 Interruptions of Utilities:

12.3.1 No utility services shall be interrupted by the Contractor to make connections, to relocate, or for any purpose without approval of the Contracting Officer.

12.3.2 Request for Permission to shut down services shall be submitted in writing to the Contracting Officer not less than seventeen (17) days prior to date of proposed interruption. The request shall give the following information:

(1) Nature of Utility (Gas, L.P. or H.P., Water, etc.)

(2) Size of line and location of shutoff.

(3) Buildings and services affected.

(4) Hours and date of shutoff.

(5) Estimated length of time services will be interrupted.

12.3.3 Services shall not be shutoff until receipt of approval of the proposed hours and date from the Contracting Officer.

12.3.4 Shutoffs which will cause interruption of Government work operations as determined by the Contracting Officer shall be accomplished during regular non-work hours or on non-work days of the Using Agency without any additional cost to the Government.

12.3.5 Operation of valves on water mains will be by Government personnel. Where shutoff of water lines interrupts service to fire hydrants or fire sprinkler systems, the Contractor shall arrange his operations and have sufficient material and personnel available to complete the work without undue delay or to restore service without delay in event of emergency.

12.3.6 Flow in gas mains which have been shut off shall not be restored until the Government inspector has determined that all items serviced by the gas line have been shut off.

13. NOT USED.

15 June 1990
(1) 14. LAYOUT OF WORK (APR 1984) FAR 52.236-17. The Contractor shall lay out its work from Government-established coordinates and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at his own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

15 June 1990
15. PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984) FAR 52.236-1
(Para. 15 only). The Contractor shall perform on the site, and with its own organization, work equivalent to at least 20 percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

15.1 For purposes of this paragraph "WORK BY THE CONTRACTOR" is defined as prime Contractor direct contract labor (including testing and layout personnel), exclusive of other general condition or field overhead personnel, material, equipment, or subcontractors. The "TOTAL AMOUNT OF WORK" is defined as total direct contract labor (including testing and layout personnel), exclusive of other general condition or field overhead personnel, material, or equipment.

15.2 Within 7 days after the award of any subcontract, either by himself or a subcontractor, the Contractor shall deliver to the Contracting Officer a completed SF 1413, "Statement and Acknowledgment." The form shall include the subcontractor's acknowledgement of the inclusion in his subcontract of the clauses of this contract entitled "Davis-Bacon Act," "Contract Work Hours and Safety Standards Act-Overtime Compensation," "Apprentices and Trainees," "Compliance with Copeland Regulations," "Withholding of Funds," "Subcontracts," "Contract Termination-Debarment," and "Payrolls and Basic Records." Nothing contained in this contract shall create any contractual relation between the subcontractor and the Government.

16. NOT USED.

24 February 1992
17. SUPERINTENDENCE OF SUBCONTRACTORS

17.1 The Contractor shall be required to furnish the following, in addition to the superintendence required by CONTRACT CLAUSE: SUPERINTENDENCE BY THE CONTRACTOR:

The Contractor shall be required to furnish two such superintendents to be responsible for coordinating, directing , inspecting and expediting the subcontract work.

17.2 If the Contracting Officer, at any time after 50 percent of the subcontracted work has been completed, finds that satisfactory progress is being made, he may waive all or part of the above requirements for additional superintendence subject to the right of the Contracting Officer to reinstate such requirement if at any time during the progress of the remaining work he finds that satisfactory progress is not being made.

15 June 1990

18. IDENTIFICATION OF EMPLOYEES.

18.1 The Contractor shall be responsible for furnishing an identification badge/card to each employee prior to the employees work on-site, and for requiring each employee engaged on the work to display identification as may be approved and directed by the Contracting Officer. All prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of the employee. When required by the Contracting Officer, the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project.

18.2 Not Used.

24 February 1992
19. Not Used

20. WARRANTY OF CONSTRUCTION (MAR 1984) ALTERNATE 1 (APR 1984) FAR 52.246-21I.

20.1 General Requirements.

20.1.1 In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph 20.1.10 of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

20.1.1.1 Warranty Payment

Warranty work is a subsidiary portion of the contract work, and has a value to the Government approximating 0.5% of the contract award amount. The Contractor will assign a value of that amount in the breakdown for progress payments mentioned in the Contract Clause: Payments Under Fixed-Price Construction Contracts. If the Contractor fails to respond to warranty items as provided in paragraph 20.5, the Government may elect to acquire warranty repairs through other sources and, if so, shall back charge the Contractor for the cost of such repairs. Such back charges shall be accomplished under the Changes Clauses of the contract through a credit modification(s).

20.1.1.2 Since the warranty period will extend beyond the construction completion date, this contract shall remain open until the warranty period expires.

20.1.2 This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(a) As a part of the one year warranty inspection, the Contracting Officer will conduct an infrared roof survey on any project involving a membrane roofing system. This survey will be conducted in accordance with ASTM C1153-90, "Standard Practice for the Location of Wet Insulation in Roofing Systems Using Infrared Imaging". In accordance with paragraph 20.1.3 and 20.1.4, the Contractor shall be required to replace all damaged materials and to locate and repair sources of moisture penetration, at no additional cost to the Government.

(b) Nine months after final acceptance and prior to the one year warranty expiration, the Contractor shall inspect the masonry construction, and shall clean/remove all block/brick efflorescence, tuckpoint any loose or missing mortar joints, and stain and reseal the areas affected by this cleaning and repair operation. This operation shall be done in conformance with specification section 04200 MASONRY, paragraph 3.21 Pointing and Cleaning.

20.1.3 The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

(a) The Contractor's failure to conform to contract requirements; or

(b) Any defect of equipment, material, workmanship, or design furnished.

20.1.4 The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

20.1.5 The Contracting Officer shall notify the Contractor, in writing, (see para. 20.2.3 and 20.5) within a reasonable time after the discovery of any failure, defect, or damage.

20.1.6 If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, (see para. 20.5) the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

20.1.7 With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(a) Obtain all warranties that would be given in normal commercial practice;

(b) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the 247 Contracting Officer; and

(c) Provide names, addresses, and telephone numbers of all subcontractors, equipment suppliers, or manufacturers 248 with specific designation of their area of responsibilities if they are to be contacted directly on warranty 249 corrections; and

(d) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

20.1.8 In the event the Contractor's warranty under paragraph 20.1.2 of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

20.1.9 Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

20.1.10 This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

20.1.11 Defects in design or manufacture of equipment specified by the Government on a "brand name and model" basis, shall not be included in this warranty. In this event, the Contractor shall require any subcontractors, manufacturers, or suppliers thereof to execute their warranties, in writing, directly to the Government.

20.2 Performance Bond.

20.2.1 The Contractor's Performance Bond will remain effective throughout the construction warranty period and warranty extensions.

20.2.2

(a) In the event the Contractor or his designated representative(s) fails to commence and diligently pursue any work required under this clause, and in a manner pursuant to the requirements thereof, the Contracting Officer shall have the work performed by others, and after completion of the work, will charge the remaining warranty funds

established by paragraph 20.1.1.1 of any or all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

(b) In the event sufficient funds are not available to cover the warranty work performed by the Government at the Contractor's expense, the Contracting officer shall have the right to recoup expenses from the bonding company.

20.2.3 Following oral or written notification of required warranty repair work, the Contractor will respond as dictated by para. 20.5. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor as outlined in the paragraph 20.2.2 above.

20.3 Pre-Warranty Conference. Prior to contract completion and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this clause. Communication procedures for Contractor notification of warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of a licensed and bonded company that is authorized to initiate and pursue warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of his responsibilities in connection with other portions of this provision.

20.4 Equipment Warranty Identification Tags.

20.4.1 The Contractor shall provide warranty identification tags on all Contractor and Government furnished equipment which he has installed.

(a) The tags shall be similar in format and size to the exhibits provided by this specification, they shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and they shall be installed in a position that is easily (or most easily) noticeable. Contractor furnished equipment that has differing warranties on its components will have each component tagged.

(b) Sample tags shall be submitted for Government review and approval. These tags shall be filled out representative of how the Contractor will complete all other tags.

(c) Tags for Warranted Equipment: The tag for this equipment shall be similar to the following. Exact format and size will be as approved.

EQUIPMENT WARRANTY
CONTRACTOR FURNISHED EQUIPMENT

MFG MODEL NO.

SERIAL NO.

CONTRACT NO.

CONTRACTOR NAME

CONTRACTOR WARRANTY EXPIRES

MFG WARRANTY(IES) EXPIRE

EQUIPMENT WARRANTY
GOVERNMENT FURNISHED EQUIPMENT

MFG MODEL NO.

SERIAL NO.

CONTRACT NO.

DATE EQUIP PLACED IN SERVICE

MFG WARRANTY(IES) EXPIRE

(d) If the manufacturer's name (MFG), model number and serial number are on the manufacturer's equipment data plate and this data plate is easily found and fully legible, this information need not be duplicated on the equipment warranty tag. The Contractor warranty expires (warranty expiration date) and the final manufacturer's warranty expiration date will be determined as specified by para. 20.1.

20.4.2 Execution. The Contractor will complete the required information on each tag and install these tags on the equipment by the time of and as a condition of final acceptance of the equipment.

20.4.3 Payment. The work outlined above is a subsidiary portion of the contract work, and has a value to the Government approximating 5% of the value of the Contractor furnished equipment. The Contractor will assign a value of that amount in the breakdown for progress payments mentioned in the Contract Clause: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS.

20.4.4 Equipment Warranty Tag Replacement. As stated in para. 20.1.4, the Contractor's warranty with respect to work repaired or replaced shall run for one year from the date of repair or replacement. Such activity shall include an updated warranty identification tag on the repaired or replaced equipment. The tag shall be furnished and installed by the Contractor, and shall be identical to the original tag, except that the Contractor's warranty expiration date will be one year from the date of acceptance of the repair or replacement.

20.5 Contractor's Response to Warranty Service Requirements.

20.5.1 Following oral or written notification by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, the Contractor shall respond to warranty service requirements in accordance with the "Warranty Service Priority List" and the three categories of priorities listed below. If the Contractor does not perform the warranty within the time frame specified, the Government will perform the work and back charge the warranty payment item established under paragraph 20.1.1.1.

First Priority Code 1 Perform on site inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

Second Priority Code 2 Perform on site inspection to evaluate situation and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

Third Priority Code 3 All other work to be initiated within 3 work days and work continuously to completion or relief.

The "Warranty Service Priority List" is as follows:

Code 1 Air Conditioning Systems
- a. Recreational support.
- b. Air conditioning leak in part of building, if causing damage.
- c. Not cooling unit

Code 3 Doors
- a. Overhead doors not operational.
- b. Interior/Exterior personnel doors or hardware not functioning properly.

Code 1 Electrical
- a. Power failure (entire area or any building operational after 1600 hours).
- b. Security lights.
- c. Smoke Detectors.

Code 2 Electrical
- a. Power failure (no power to a room or part of building).
- b. Receptacle and lights (in a room or part of building).

Code 3 Electrical
- a. Street Lights.

Code 1 Gas
- a. Leaks and breaks.
- b. No gas to family housing unit or cantonment area.

Code 1 Heat
- a. Area power failure affecting heat.
- b. Heater in unit not working.

Code 1 Hot Water heater Failure

Code 2 Kitchen Equipment
- a. Dishwasher.
- b. All other equipment hampering preparation of a meal.

Code 3 Plumbing
- a. Leaky faucets.

Code 2 Plumbing
- a. Flush valves.
- b. Fixture drain, supply line commode, or any water pipe leaking.
- c. Commode leaking at base.

Code 3 Interior
- a. Floors
- b. Paint chipping or peeling
- c. Casework

Code 1 Roof Leaks

Temporary repairs will be made where major damage to property is occurring.

Code 2 Roof Leaks
Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2 Water (Exterior)
No water to facility.

Code 2 Water, Hot
No hot water in portion of building listed

Code 3 All other work not listed above.

20.5.2 Should parts be required to complete the work and the parts are not immediately available the Contractor shall have a maximum of 12 hours after arrival at the job site to provide the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, with firm written proposals for emergency alternatives and temporary repairs for Government participation with the Contractor to provide emergency relief until the required parts are available on site for the Contractor to perform permanent warranty repair. The Contractors proposals shall include a firm date and time that the required parts shall be available on site to complete the permanent warranty repair. The Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, will evaluate the proposed alternatives and negotiate the alternative considered to be in the best interest of the Government to reduce the impact of the emergency condition. Alternatives considered by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer will include the alternative for the Contractor to "Do Nothing" while waiting until the required parts are available to perform permanent warranty repair. Negotiating a proposal that will require Government participation and the expenditure of Government funds shall constitute a separate procurement action by the using service.

20.5.3 The Contractor shall provide to the Government all service records of warranty work performed during the warranty period. Records shall be indicated by building number and be sorted according to discipline, i.e. mechanical equipment, electrical, plumbing. The records shall contain a description of the problem, repairs made, dates notified/corrected. Four (4) bound copies of the record shall be submitted within 20 calendar days of completion of the warranty period. When all required warranty actions are completed and submission of the records made, the remaining available monies stipulated in paragraph 20.1.1.1 shall be released for final payment on the contract.

15 JUNE 1990
(1) 21. DAMAGE TO WORK (ORL) The responsibility for damage to any part of the permanent work shall be as set forth in CONTRACT CLAUSE: PERMITS AND RESPONSIBILITIES. However, if in the judgment of the Contracting Officer, any part of the permanent work performed by the Contractor is damaged by flood or earthquake, which damage is not due to the failure of the Contractor to take reasonable precautions or to exercise sound engineering and construction practices in the conduct of the work, the Contractor will make the repairs as ordered by the Contracting Officer and full compensation for such repairs will be made at the applicable contract unit or lump sum prices as fixed and established in the contract. If, in the opinion of the Contracting Officer, there are no contract unit or lump sum prices applicable to any part of such work, an equitable adjustment pursuant to CONTRACT CLAUSE: CHANGES, will be made as full compensation for the repairs of that part of the permanent work for which there are no applicable contract unit or lump sum prices. Except as herein provided, damage to all work (including temporary construction), utilities, materials, equipment and plant shall be repaired to the satisfaction of the Contracting Officer at the Contractor's expense, regardless of the cause of such damage.

22-28 Not Used

15 June 1990

29. AGGREGATE SOURCES.

29.1 Material sources which previously met or exceeded the quality standards set forth in the technical sections of the specifications (C-33-93 Standards for Structural Concrete, C-33-93 4S and attached project requirements for concrete pavements, and KDOH 1998 Standards for asphalt, stone/base, subbase and DGA), are tabulated below.

a. Coarse material sources for base course, bituminous paving, cast-in-place structural concrete, concrete pavements and pre-cast architectural concrete.

(1). Kentucky Stone Company, Canton, Kentucky. Ledges 2 and 3, about 33 feet.

(2). Vulcan Materials Company, Gilbertsville, Kentucky. Ledges 4 and 26, about 393 feet.

(3). Martin-Marietta Aggregates, Smithland, Kentucky. Ledges 16 to 19, about 51 feet.

(4). Hopkinsville Stone Company, Hopkinsville, Kentucky. Ledges 1B, 2A, 2B, 3A, 3B, 3C, 3D, 5, 6, 7, 8, 11, 12, 13, and 14 about 115 feet.

b. Natural Fine aggregates sources for concrete, asphalt, stone-base, subbase and DGA are listed below.

(1) Delta Materials, Henderson, Kentucky

(2) Ingram Materials, Paducah, Kentucky

(3) Mayfield Aggregates, Mayfield, Kentucky

(4) Delta Materials, Cairo, Illinois

c. Manufactured fine aggregates for concrete, Hopkinsville Stone Company, Hopkinsville, Kentucky.

29.2 Aggregates may be furnished from any of the above listed sources or at the option of the Contractor may be furnished from any other source designated by the Contractor and approved by the Contracting Officer, subject to the conditions hereinafter stated.

29.3 Source. After the award of the contract, the Contractor shall designate in writing only one source or one combination of sources from which he proposes to furnish aggregates. If the Contractor proposes to furnish aggregates from a source or from sources not listed above, he may designate only a single source or single combination of sources for aggregates. Samples for acceptance testing shall be provided as required by the technical portions of these specifications. If a source for coarse or fine aggregate so designated by the Contractor is not approved for use by the Contracting Officer, the Contractor may not submit for approval other sources, but shall furnish the coarse or fine aggregate, as the case may be, from a source listed above at no additional cost to the Government.

29.4 Listing of a concrete aggregate source is not to be construed as approval of all material from that source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels, when such materials are unsuitable for concrete aggregate as determined by the Contracting Officer. Materials produced from an approved source shall meet all requirements of the technical portions of these specifications.

24 February 1992

30. NOT USED.

1 February 1995
(2) 31. PROJECT SIGN.

31.1 General. The Contractor shall furnish and erect at the location directed one project sign.

Exact placement location will be designated by the Contracting Officer. The panel sizes and graphic formats have been standardized for visual consistency throughout all Corps operations.

Panels are fabricated using HDO plywood with dimensional lumber uprights and bracing.

All legends are to be painted in the sizes and styles as specified by the graphic formats shown at the end of this section. The signs (including back and edges), posts and braces shall be given two coats of Benjamin Moore No. 120-60 poly-silicone enamel or approved equal before lettering. The 4' x 4' right section of the project sign shall be white with black lettering. The 2' x 4' left section shall be Communication Red (CR) with white lettering. Paint colors shall be as follow:

Black - Federal Standard 595a Color Number 27038
White - Federal Standard 595a Color Number 27875
Red - PANTONE 032

An example of the sign including mounting and fabrication details are also provided at the end of this section.

Name of the project shall be as follows:

DISCOM BARRACKS COMPLEX PHASE I/IIA
FORT CAMPBELL, KENTUCKY

Name of the designer shall be as follows:

U.S. ARMY CORPS OF ENGINEERS, LOUISVILLE DISTRICT

31.2 Erection and Maintenance. The signs shall be erected at the designated location(s). Signs shall be plumb and backfill of post holes shall be well tamped to properly support the signs in position throughout the life of the contract. The signs shall be maintained in good condition until completion of the contract, shall remain the property of the Contractor, and shall be removed from the site upon completion of work under the contract.

31.3 The Corps of Engineers logo will be provided by the Contracting Officer.

31.4 Payment. No separate payment will be made for furnishing and erecting the project signs as specified and costs thereof shall be considered a subsidiary obligation of the Contractor.

32. NOT USED.

1 February 1995
33. WAGE RATES. The decision of the Secretary of Labor, covering rates of wages, including fringe benefits to be paid laborers and mechanics performing work under this contract, is attached hereto. The payment for all classes of laborers and mechanics actually employed to perform work under the contract will be specified in the following contract clauses: DAVIS-BACON ACT, CONTRACT WORK HOURS AND SAFETY STANDARDS ACT, and THE COPELAND ACT.

Wage decisions included are:

KY980005 Building
KY980025 Heavy/Highway

The building decision applies to construction of DISCOM Barracks Complex. The Heavy/Highway decision applies to all other work located outside the 5 foot building line.

34. NOT USED.

15 June 1990
35. INTERFERENCE WITH TRAFFIC AND PUBLIC AND PRIVATE PROPERTY.

35.1 The Contractor at all times shall dispose his plant and conduct the work in such manner as to cause as little interference as possible with private and public travel. Damage (other than that resulting from normal wear and tear) to roads, shall be repaired to as good a condition as they were prior to the beginning of work and to the satisfaction of the Contracting Officer.

35.2 Not Used.

36. SEQUENCE OF WORK. This contract (Phase I/IIA) is the first of a three phase project and shall be completed not later than 1080 days from Notice to Proceed (NTP). The sitework for (included in Phase I) Phase IIB, as indicated on the civil drawings, shall be completed in this contract as a part of Phase I not later than 365 days from Notice to Proceed.

37. NOT USED.

1 August 1996
38. COMPLIANCE WITH POST/BASE REGULATIONS. The site of the work is on a military reservation and all rules and regulations issued by the Commanding Officer covering general safety, security, sanitary requirements, pollution control and traffic regulations, shall be observed by the Contractor. Information regarding these requirements may be obtained by contacting the Contracting Officer, who will provide such information or assist in obtaining same from appropriate authorities.

38.1 Contractor personnel shall park only in areas authorized by the Contracting Officer.

38.2 The Contractor shall provide a Seven Day Notice to the Contracting Officer, in writing, before required soil treatment agents are applied, to assure that DOD Certified Pest Control Personnel are present during soil treatment applications. All soil treatment applications must be in the presence of DOD Certified Pest Control personnel.

20 March 1997
39. EQUIPMENT AND OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995)
EFAR 52.231-5000.

39.1 This does not apply to terminations. See 52.249,5000, Basis for Settlement of Proposals and FAR Part 49.

39.2 Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region II. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the Contracting Officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be

developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time of negotiations shall apply.

39.3 Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

39.4 When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the Contracting Officer shall request the Contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Cover Sheet.

39.5 Whenever a modification or equitable adjustment of contract price is required, the contractor's cost proposals for equipment ownership and operating expenses shall be determined in accordance with the requirements of SPECIAL CONTRACT REQUIREMENT: EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE. A copy of EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule" is available for review at the office of the District Engineer, Room 821, 600 Dr. Martin Luther King, Jr. Place, Louisville, Kentucky, or a copy may be ordered from the Government Printing Office at a cost of $11.00 by calling telephone no. (301) 953-7974.

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10	008-022-00263-4
11	008-022-00264-2
12	008-022-00265-1

15 June 1990

40. LABOR, EQUIPMENT, AND MATERIAL REPORTS.

40.1 Daily Equipment Report. The Contractor shall submit a daily report of all Contractor-owned or rented equipment at the jobsite. A similar report is required for all subcontractor equipment. The subcontractor's report may be separate or included with the Contractor's report provided the equipment is adequately identified as to ownership. The required equipment report shall include each item of equipment (hand-operated small tools or equipment excluded) on the job and shall specifically identify each item as to whether it is Contractor-owned or rented, shifts, hours of usage, downtime for repairs, and standby time. Identification of the equipment shall include make, model and plant number of all items. Separate identification by a key sheet providing these data may be utilized with the daily report indicating the type of equipment and the equipment plant numbers. The format of the Daily Equipment Report will be as approved by the Government in the field.

40.2 Labor, Equipment & Material Reports for Extra Work/Cost. A Report shall also be submitted by the Contractor listing any labor, equipment and materials expended on and/or impacted by any change order directed by the Government and for which total price/time agreement has not been reached. These requirements also apply to subcontractors at any tier. The same Report is required at any time the Contractor claims or intends to claim for extra costs whether or not there is Government recognition (constructive changes). This requirement is in addition to any Contractor "Notice" or "Reservation of Rights". Submittal of such a report will not be construed as satisfying the "Notice" required under the "Changes" clause or any other clause. But, absence of such Reports submitted to the Government contemporaneously with the alleged extra work/cost will be considered as evidence that no such extra work/cost occurred that are chargeable to the Government.

40.3 The Report shall be detailed to the degree required by the Government in the field and shall contain the following as a minimum:

a. The cause of the extra labor, equipment or materials costs.

b. For extra labor - Indicate crew, craft, hours, location and cost. Describe nature or type of extra costs, i.e, extra work, overtime, acceleration, interference, reassignment, mobilizations and demobilizations, supervision, overhead, type of inefficiency, etc.

c. For extra equipment - Indicate type and description, hours, location, cost; whether working, idle, standby, under repair, extra work involved, etc.

d. For extra materials - Indicate type and description, where used, whether consumed, installed or multi-use, quantity, cost, extra work involved, etc.

e. Affected activities - Relate to Contract Schedule (Network Analysis); demonstrate whether delay or suspension is involved.

f. Segregate all entries by prime and each subcontractor.

g. Summarize costs daily and by cumulative subtotal or with frequency required by the Government.

40.4 This Report will not be considered as evidence that any of the alleged extra costs actually occurred. The Report will be used to check against over obligation of funds for change orders directed prior to price/time agreement and to track alleged extra costs the Contractor considers otherwise chargeable against the Government. The Government may respond at any interval to either challenge, amend or confirm the Report. Absence of a Government response is not to be considered acquiescence or denial. The Government may order work stoppage if deemed necessary to avoid over obligation of funds. The frequency of the report shall be daily or as otherwise approved by the Government representative in writing.

41. NOT USED.

24 January 1994

42. PROGRESS PHOTOGRAPHS. The Contractor shall, during the progress of the work, furnish the Contracting Officer photographs, slides and negatives depicting construction progress. The photographic work furnished shall be commercial quality as determined by the Contracting Officer. The photography shall be performed between the first and fifth of each month and the photographs, slides and negatives delivered to the Contracting Officer not later than the 15th of each month taken. A maximum of six aerial views and six views from different positions shall be taken as directed to show, inasmuch as possible, work accomplished during the previous month. At least, one set of photographs, slides and negatives will be made at completion of the contract, after final inspection by the Contracting Officer. For work extending over considerable area or length, such as road construction and timber clearing, aerial photographs shall be furnished periodically, at least on alternate months, in lieu of conventional

photographs. The photographs shall be 8"x10" color prints and the slides 35 mm color. Each photograph and slide shall be identified on the face of the picture or the border of the slide giving date made, contract title and number, location of work, as well as a brief description of work depicted. Each negative will be identified with the same information on a sheet of paper by cross-referencing to the number on the negative. Two copies of photographs and slides, along with the original negatives of each view taken, shall be furnished to the Contracting Officer by the time stipulated above. No separate payment will be made for these services and all costs in connection thereto shall be considered a subsidiary obligation of the Contractor.

20 March 1997

43. PAYMENT FOR MATERIALS DELIVERED OFFSITE. (MAR 1995) EFARS 52.232-5000.

43.1 Pursuant to CONTRACT CLAUSE: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS, materials delivered to the Contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the CONTRACT CLAUSES are fulfilled. Payment for items delivered to locations other than the worksite will be limited to:

(1) Materials required by the technical provisions,

(2) Materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.

43.2 Such payment will be made only after receipt of paid or receipted invoices or invoices with canceled check showing title to the items in the prime contract and including the value of material and labor incorporated into the item. In addition to petroleum products, payment for materials delivered off-site is limited to the following items:

List items for which payments will be made
for off-site delivery.

44. NOT USED.

17 July 1992

45. INSURANCE--WORK ON A GOVERNMENT INSTALLATION (SEP 1989) FAR 52.228-5.

45.1 The Contractor shall, at its own expense, provide and maintain during the entire performance of this contract at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

(1) Coverage complying with State laws governing insurance requirements, such as those requirements pertaining to Workman's Compensation and Occupational Disease Insurance. Employer's Liability Insurance shall be furnished in limits of not less than $100,000.00 except in states with exclusive or monopolistic funds.

(2) Comprehensive General Liability Insurance for bodily injury coverage shall be furnished in limits of not less than $500,000 per occurrence.

(3) Comprehensive Automobile Liability Insurance for both bodily injury and property damage, shall be furnished in limits of not less than $200,000.00 per person, $500,000.00 per accident for bodily injury, and $20,000.00 per accident for property damage. When the Financial Responsibility or Compulsory Insurance Law of the State, requires higher limits, the policy shall provide for coverage of at least those higher limits.

45.2 Before commencing work under this contract, the Contractor shall certify to the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribe, or

(2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

45.3 The Contractor shall insert the substance of this clause, including this paragraph (45.3), in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.
1 August 1996

46. IMPLEMENTATION OF GOVERNMENT RESIDENT MANAGEMENT SYSTEM

46.1 The Contractor shall utilize a Government furnished software program titled, "RMS" (Resident Management System) to maintain critical information needed to manage the project. RMS produces up-to-date management and analysis reports as well as a majority of the forms required in this contract for submission to the Government. Some of these forms are shown as samples at the end of this section. They include ENG 4288 (Submittal Register), ENG 4025 (Transmittal form), CQC Daily Report, Transfer Property Information Form, Definable Feature of Work Form, User Schooling Information Form, Quality Control Testing Information, and Installed Property Information Form.

46.2 The following hardware and software are needed by the Contractor to run RMS: a personal computer with 80386 process (or higher) and four megabytes (MB) or more of random access memory (RAM) and a 3 1/2 inch high density floppy drive. Also needed is a HP Laser Jet Series II, III, IV or V printer, a color monitor, MS-DOS, version 5.0 or later, Word Perfect, version 5.1 or later, and Computer files = 81.

46.3 Once the Contract is awarded, the Contractor will be given a cop of the RMS program for implementation. A meeting between the Government and the Contractor will be arranged to inform the Contractor on the use of the software package which is similar to the one the Government will use to manage the project. File updates will be transferred to the Government by disk on a weekly basis, unless electronic transfers are agreed on.

47. NOT USED.

15 June 1990
48. DEFINITIONS. The following provision is applicable to the SPECIFICATIONS, of this solicitation: The term GENERAL PROVISIONS shall mean CONTRACT CLAUSES, the terms SPECIAL PROVISIONS and SPECIAL CLAUSES shall mean SPECIAL CONTRACT REQUIREMENTS.

49. NOT USED.

2 January 1991
50. TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER. ER 415-1-15 (31 OCT 89)

50.1 This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the contract clause entitled "Default: Fixed Price Construction)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

50.1.1 The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

50.1.2 The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

50.2 The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for

monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY
WORK DAYS BASED ON (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
(9)	(6)	(6)	(6)	(5)	(4)	(5)	(4)	(4)	(4)	(4)	(6)

50.3 Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph 50.2, above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract clause entitled "Default (Fixed Price Construction)".

1 August 1996
51. NOT USED.

4 June 1993
52. USE OF INCLINOMETER FOR LONG BED DUMP TRUCKS (DACF BULLETIN 25 MARCH 1993) The recommendation of EM 385-1-1, Section 16.B.15, is mandatory for this project.

20 March 1997
53. AVAILABILITY OF SAFETY AND HEALTH REQUIREMENTS MANUAL (EM 385-1-1).
As covered by CONTRACT CLAUSE "ACCIDENT PREVENTION", compliance with EM 385-1-1 is a requirement for this contract. Copies may be purchased for $31.00 each at the following address:

United States Government Bookstore
Room 118, Federal Building
1000 Liberty Avenue
Pittsburgh, PA 15222
Telephone: (412) 644-2721
FAX: (412) 644-4547

15 April 1991
54. FIRE PROTECTION DURING CONSTRUCTION (MIL-HDBK-1008c Para. 2.9.2)
The Contractor is alerted to the requirements of Contract Clause "CLEANING UP" and more specifically to the requirements for fire protection during construction spelled out in EM 385-1-1 and NFPA No. 241 Building Construction and Demolition Operations. This item must be covered in the submittal required under Contract Clause "ACCIDENT PREVENTION".

2 Jan 1996
55. HAUL ROADS

55.1 Whenever practical, one-way haul roads shall be used on this contract. Haul roads built and maintained for this work shall comply with the following:

55.1.1 One-way haul roads for off-the road equipment; e.g., belly dumps, scrapers, and off-the-road trucks shall have a minimum usable width of 25 ft. One-way haul roads for over-the-road haulage equipment only (e.g., dump

trucks, etc.) may be reduced to a usable width of 15 ft. When the Contracting Officer determines that it is impractical to obtain the required width for one-way haul roads (e.g., a road on top of a levee), a usable width of not less than 10 ft. may be approved by the Contracting Officer, provided a positive means of traffic control is implemented. Such positive means shall be signs, signals, and/or signalman and an effective means of speed control.

55.1.2 Two-way haul roads for off-the-road haulage equipment shall have a usable width of 60 ft. Two-way haul roads for over-the-road haulage equipment only may be reduced to a usable width of 30 ft.

55.1.3 Haul roads shall be graded and otherwise maintained to keep the surface free from potholes, ruts, and similar conditions that could result in unsafe operation.

55.1.4 Grades and curves shall allow a minimum sight distance of 200 ft. for one-way roads and 300 ft. for two-way roads. Sight distance is defined as the centerline distance an equipment operator (4.5 ft. above the road surface) can see an object 4.5 ft. above the road surface. When conditions make it impractical to obtain the required sight distance (e.g., ramps over levees), a positive means of traffic control shall be implemented.

55.1.5 Dust abatement shall permit observation of objects on the roadway at a minimum distance of 300 ft.

55.1.6 Haul roads shall have the edges of the usable portion marked with posts at intervals of 50 ft. on curves and 200 ft. maximum elsewhere. Such markers shall extend 6 ft. above the road surface and, for nighttime haulage, be provided with reflectors in both directions.

56.NOT USED.

57. UNEXPLODED ORDNANCE (UXO) It is not envisioned that UXO will be encountered within the construction limits of the DISCOM site. However, due to operations performed throughout the history of Fort Campbell UXO could potentially be present. The contractor should be cautious of any surface or subsurface metal objects encountered. If any object is encountered during field investigations that appear to be potentially UXO, the field activities will be stopped immediately. The siting will be reported to the contracting officers representative who will then notify the Fort Campbell UXO point of contact. If after cursory inspection, the UXO POC still suspects UXO, then the POC will notify the Huntsville Division of the U.S. Army Corps of Engineers. The government will be responsible for the location confirmation and disposition of any ordnance or explosive waste should such material be encountered.

1 November 1991

58. CONSTRUCTION HAZARD COMMUNICATION. The Contractor is required to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1926.59). This standard is designed to inform workers of safe and appropriate methods of working with hazardous substances in the workplace. The standard has five requirements, and every hazardous or potentially hazardous substance used or stored in the work area is subject to all five. They are:

(1) Hazard Evaluation. Any company which produces or imports a chemical or compound must conduct a hazard evaluation of the substance to determine its potential health or physical hazard. The hazard evaluation consists of an investigation of all the available scientific evidence about the substance. The Contractor is required to assure that all producers (manufacturer/distributors) have performed these evaluations and transmit the required information with any hazardous materials being used or stored on the project site. From the hazard evaluation, a substance may be classified as a health hazard, or a physical hazard. These classifications are then further broken down according to type:

Health Hazards	Physical Hazards
Carcinogens	Combustible liquids
Irritants	Compressed gases

Sensitizers	Explosives
Corrosives	Flammables
Toxic substances	Organic peroxides
Highly toxic substances	Unstable substances
Substances harmful to specific organs or parts of the body	Water-reactive substances

(2) Warning Labels. If a chemical is hazardous or potentially hazardous, the producer or importer must affix a warning label to every container of that chemical before it leaves his facility. The Contractor must assure these labels are attached and legible. The label must identify the chemical, state the hazard, and give the name and address of the producer or importer. If the hazardous substance is transferred to another container, that container must then be labeled, tagged, or marked with the name of the chemical and the appropriate hazard warning. Warning labels should be replaced immediately if they are defaced or removed.

(3) Material Safety Data Sheets. The producer or importer must also supply a material safety data sheet (MSDS). The Contractor must keep these available in the work area where the substance is used, so that the people using the substance can easily review important safety and health information, such as:

The hazard possible from misuse of the substance
Precautions necessary for use, handling, and storage
Emergency procedures for leaks, spills, fire and first aid
Useful facts about the substance's physical or chemical properties

(4) Work Area Specific Training. Because of hazardous substance may react differently depending on how it is used or the environment of the work area, the Contractor must conduct work area specific training; special training which takes the Contractor's operations, environment, and work policies into consideration. Work area training presents:

The hazardous substances which are present in the work place and the hazards they pose

Ways to protect against those hazards, such as protective equipment, emergency procedures, and safe handling

Where the MSDS's are kept, and an explanation of the labeling system
Where the Contractor's written Hazard Communication Program is located

(5) The Written Hazard Communication Program. In accordance with OSHA requirements, the Contractor must prepare a written Hazard Communication Program. This document will be included in the Contractor's Accident Prevention Plan. This document states how the Contractor plans to ensure that hazardous materials are appropriately labeled, how and where MSDS's will be maintained, and how employees will be provided with specific information and training.

15 June 1990
59. CORPS OF ENGINEERS PLAQUE. At the location directed by the Contracting Officer, the Contractor shall mount a Government furnished plaque. Mounting shall be with expansion bolts and rosettes. A photostatic copy of this plaque is bound at the end of these SPECIAL CONTRACT REQUIREMENTS.

60. NOT USED.

24 FEBRUARY 1992
61. MECHANICAL ROOM LAYOUT (ORL). Detailed mechanical room layout drawings shall be submitted for approval in accordance with SD-04 Section 01330. Layout drawings shall show location and maintenance clearances

for all mechanical room equipment, and all utility runs/chases for mechanical, electrical, telephone and other similar systems. Drawings shall be submitted at the same time as the submittals for the equipment to be located within the mechanical room.

62. thru 68. NOT USED.

2 January 1996

69. CONTRACT TERMINATION - BASIS FOR SETTLEMENT OF PROPOSALS. EFARS 52.249-5000. Actual costs will be used to determine equipment costs for a settlement proposal submitted on the total cost basis under FAR 49.206-2(b). In evaluating a terminations settlement proposal using the total cost basis, the following principles will be applied to determine allowable equipment costs:

(1) Actual costs for each piece of equipment, or groups of similar serial or series equipment, need not be available in the contractor's accounting records to determine total actual equipment costs.

(2) If equipment costs have been allocated to a contract using predetermined rates, those charges will be adjusted to actual costs.

(3) Recorded job costs adjusted for allowable expenses will be used to determine equipment operating expenses.

(4) Ownership costs (depreciation) will be determined using the contractor's depreciation schedule (subject to the provisions of FAR 31.205-11).

(5) License, taxes, storage and insurance costs are normally recovered as an indirect expense and unless the contractor charges these costs directly to contracts, they will be recovered through the indirect expense rate.

70. NOT USED.

8 October 1996

71. PARTNERING. In order to most effectively and efficiently accomplish the work provided for in this contract, the Government is encouraging the formation of a cohesive, mutually beneficial partnership with the Contractor and its subcontractors. This partnership would strive to draw on the strengths, skills, and knowledge of each organization in an effort to achieve a quality project, done right the first time, within budget, safely, and on schedule. Partnering still requires full compliance with the contract, but the focus of partnering is to build cooperative relationships, avoid or minimize disputes and actively pursue the attainment of common goals by the contracting parties. Success will be dependent upon teamwork characterized by open and effective communication while always adhering to the highest of professional standards. The partnership would be bilateral in makeup and participation will be totally voluntary. Any cost associated with effectuating this partnership will be agreed to by both parties and will be shared equally with no change in contract price.

72.thru 81. NOT USED.

20 March 1997

82. APPROVAL OF CONTRACT (DEC 1989) FAR 52.204-1

This contract is subject to the written approval of the Colonel, Corps of Engineers Commander and District Engineer, Louisville District, and shall not be binding until so approved.

22 June 1998

83. YEAR 2000 COMPLIANCE

a. In accordance with FAR 39.106, the Contractor shall ensure that with respect to any design, construction, goods, or services under this contract as well as any subsequent task/delivery orders issued under this contract (if applicable), all information technology contained therein shall be Year 2000 compliant. Specifically:

b. The Contractor shall:

(1) Perform, maintain, and provide an inventory of all major components to include structures, equipment, items, parts, and furnishings under this contract and each task/delivery order which may be affected by the Y2K compliance requirements.

(2) Indicate whether each component is currently Year 2000 compliant or requires an upgrade for compliance prior to government acceptance.

GENERAL DECISION KY980005 02/13/98 KY5
General Decision Number KY980005

Superseded General Decision No. KY970005

State: Kentucky

Construction Type:
BUILDING

County(ies):
CHRISTIAN

BUILDING CONSTRUCTION PROJECTS (Does not include residential construction consisting of single family homes and apartments u to and including 4 stories) in FORT CAMPBELL ONLY

Modification Number	Publication Date
0	02/13/1998

COUNTY(ies):
CHRISTIAN

SUKY1209A 03/02/1992

	Rates	Fringes
ASBESTOS WORKERS	16.50	3.71
BOILERMAKERS	20.75	5.56
BRICKLAYERS, STONE MASONS, MARBLE MASONS, TILE SETTERS, TERRAZZO WORKERS, CEMENT MASONS, AND PLASTERERS	15.57	1.50
CARPENTERS & LATHERS:		
New Work	15.39	2.80
Repair Work	14.62	2.80
ELECTRICIANS:		
Wiremen	19.19	1.40+13.25%
Cable Splicer	19.44	1.40+13.25%
ELEVATOR MECHANICS	12.62	3.29+a+b

FOOTNOTES:
a. 7 Paid Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; Friday after Thanksgiving Day; & Christmas Day

b. Employer contributes 8% of regular hourly rate to vacation pay credit for employee who has worked in business more than 5 years; 6% for less than 5 years

GLAZIERS	12.50	1.12+c

FOOTNOTE:
c. 6 Paid Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day & Christmas Day

IRONWORKERS	14.06	2.71
MILLWRIGHTS:		

New Work	16.24	2.80
Repair Work	15.27	2.80
PAINTERS:		
Brush	10.00	1.65
Spray, Sandblast, Boswain Chair, or heights over 50'	10.50	1.65
PILEDRIVERMEN:		
New Work	15.89	2.80
Repair Work	15.10	2.80
PLUMBERS & STEAMFITTERS	18.61	2.63
ROOFERS	11.40	1.81
SHEET METAL WORKERS	19.53	5.94
SPRINKLER FITTERS	19.50	4.83

LABORERS:

GROUP 1	11.70	2.30
GROUP 2	11.85	2.30
GROUP 3	12.20	2.30

LABORER CLASSIFICATIONS

GROUP 1 - General; Wrecking Laborer on Buildings; Clearing Right-of-way & Building Site; Carpenter Tender; Truck Spotter & Dumper; Axe & Cross Cut Saw Filer; Concrete Pudler & Form Stripper; & Deckhand Flagging Traffic

GROUP 2 - Power Driven Tool; Hod Carrier; Mason Tender; Finisher Tender; Mortar Mixer; Jackhammer; Vibrator; Wagon Drill; Core Drill; Test Drill; Well Drill; Concrete Pump Machine; Tunnel Boring Machine; Man in Tunnel & Crib Ditch Work; Signal Person; Riprap Rock Setter & Handler; Asphalt Raker; Tamper & Smoother; Pipe Layer; Grout Pump Man; Chain Saw Pipe Clearing; Doping & Wrapping; Swamper & Straight Cable Hooking; Cement Gun, Grade Checker Machine Excavating; Batch Plant Scale Man; Sand Hog, Free Air; Sand Hog, Compressed Air; Cutting Torch Man on Salvage Work; Road Form Setter; Brick Slinger; Hand Spiker; Power Buggy; Handling of Creosote Material; Sandblaster; Curing of Concrete & Apply Hardener; Air & Gas Tamper; Concrete Saw; Power Post Hole Digger & Green Cut Man on Concrete Work

GROUP 3 - Powderman & Blaster

POWER EQUIPMENT OPERATORS:		
GROUP 1	15.25	3.15
GROUP 2	12.51	3.15
GROUP 3	11.74	3.15

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1 - Auto Patrol; Batcher Plant; Bituminous Paver; Cable Way; Central Compressor Plant; Clamshell; Concrete Mixer (21 cu. ft. or Over); Concrete Pump; Crane; Crusher Plant; Derrick; Derrick Boat; Ditching & Trenching Machine; Dragline; Dredge Operator; Dredge Engineer; Elevating Grader; Loader; Hoe-type Machine; Hoist (1-Drum when used for Stack or Chimney construction or repair); Hoisting Engine 2-Drums or More);

Locomotive; Motor Scraper; Carry-all Scoop; Bulldozer; Mechanic; Orangepeel Bucket; Pile Driver; Power Blade; Motor Grader; Roller (Bituminous); Scarifier; Shovel; Tractor Shovel; Truck Crane; Winch Truck; Push Dozer; High Lift; Fork Lift (regardless of lift height & except when used for Masonry Construction); Boom Cat; Core Drill; Hopto; Tow or Push Boat; A-frame Winch Truck; Concrete Paver; Gradeall; Hoist; Hyster; Pumpcrete; Ross Carrier; Boom; Tail Boom; Rotary Drill; Hydro Hammer; Mucking Machine; Rock Spreader attached to equipment; Scoopmobile; KeCal Loader; Tower Cranes (French, German & other types); Hydro Crane; Backfiller; Gurry; & Sub-Grader

GROUP 2 - Air Compressor (Over 900 CFM); Bituminous Mixer; Joint

Sealing Machine; Concrete Mixer (Under 21 cu. ft.); Form Grader; Roller (Rock); Tractor (50 HP & Over); Bull Float; Finish Machine; Outboard Motor Boat; Flexplane; Fireperson; Boom-type Tamping Machine; Truck Crane Oiler; Greaser on Grease facilities servicing Heavy Equipment; Switchman or Brakeman; Whirley Oiler; Self-propelled Compactor; Tractair & Road Widening Trencher; Farm Tractor with attachments (except Backhoe, High Lift & End Loader); Elevator (when used to hoist building materials); Hoisting Engine (1-Drum or Buck Hoist); Fork Lift (when used for Masonry Construction); Well Point; Grout Pump; Throttle-Valve Man; Tugger; & Electric Vibrator Compactor

GROUP 3 - Bituminous Distributor; Cement Gun; Conveyor; Mud Jack; Paving Joint Machine; Roller (Earth); Tamping Machine; Tractor (Under 50 HP); Vibrator; Oiler; Concrete Saw; Burlap & Curing Machine; Hydro-Seeder; Power Form Handling Equipment; Deckhand Steersman; & Hydraulic Post Driver

TRUCK DRIVERS:

GROUP 1	12.80	d
GROUP 2	13.45	d
GROUP 3	13.40	d

FOOTNOTE:
d. $13.00 per day

TRUCK DRIVER CLASSIFICATIONS

GROUP 1 - Up to but not including 5 Tons, such as Station Wagon, Auto, Pick-up, Dump, Flat Bed & Stake Body

GROUP 2 -5 tons & Over, including Euclid, Winch, Dempster, Dumpster, Crawler-type, Tandem Dump, etc.; Tractor-Trailer & similar equipment such as Low Boy, Distributor, Water Tank, Fork Lift, etc.; Ready Mix; & Mechanics

GROUP 3 - Greaser & Tire Changer

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Unlisted classifications needed for work not included within

the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(v)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review

Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U. S. Department of Labor

200 Constitution Avenue, N. W.
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

GENERAL DECISION KY980025 11/13/98 KY25
General Decision Number KY980025

Superseded General Decision No. KY970025

State: Kentucky

Construction Type:
HEAVY
HIGHWAY

County(ies):

ALLEN	FULTON	MCCRACKEN
BALLARD	GRAVES	MCLEAN
BUTLER	HANCOCK	MUHLENBERG
CALDWELL	HENDERSON	OHIO
CALLOWAY	HICKMAN	SIMPSON
CARLISLE	HOPKINS	TODD
CHRISTIAN	LIVINGSTON	TRIGG
CRITTENDEN	LOGAN	UNION
DAVIESS	LYON	WARREN
EDMONSON	MARSHALL	WEBSTER

Heavy and Highway Construction Projects

Modification Number	Publication Date
0	02/13/1998
1	02/20/1998
2	04/03/1998
3	05/22/1998
4	06/05/1998
5	06/19/1998
6	07/06/1998
7	07/24/1998
8	08/14/1998
9	11/13/1998

COUNTY(ies):

ALLEN	FULTON	MCCRACKEN
BALLARD	GRAVES	MCLEAN
BUTLER	HANCOCK	MUHLENBERG
CALDWELL	HENDERSON	OHIO
CALLOWAY	HICKMAN	SIMPSON
CARLISLE	HOPKINS	TODD
CHRISTIAN	LIVINGSTON	TRIGG
CRITTENDEN	LOGAN	UNION
DAVIESS	LYON	WARREN
EDMONSON	MARSHALL	WEBSTER

BRIN0004C 04/01/1998

	Rates	Fringes
CRITTENDEN, DAVIESS, HANCOCK, HENDERSON, LIVINGSTON, MCLEAN, OHIO, UNION & WEBSTER COUNTIES:		
BRICKLAYERS	21.61	5.15

BRTN0004E 05/01/1997

	Rates	Fringes
ALLEN, BALLARD, BUTLER, CALDWELL, CALLOWAY, CARLISLE, CHRISTIAN, EDMONSON, FULTON, GRAVES, HICKMAN, HOPKINS, LOGAN, LYON, MARSHALL, MCCRACKEN, MUHLENBERG, SIMPSON, TODD, TRIGG & WARREN COUNTIES:		
BRICKLAYERS	19.09	1.60

CARP0357C 07/01/1998

	Rates	Fringes
CARPENTERS	18.45	4.93
PILEDRIVERMEN	18.70	4.93
DIVERS	28.05	4.93

CARP1031M 06/01/1998

	Rates	Fringes
ALLEN, BUTLER, EDMONSON, LOGAN, SIMPSON & WARREN COUNTIES:		
MILLWRIGHTS	20.20	7.95

CARP1080E 06/16/1997

	Rates	Fringes
BALLARD, CALDWELL, CALLOWAY, CARLISLE, CHRISTIAN, CRITTENDEN, FULTON, GRAVES, HICKMAN, HOPKINS, LIVINGSTON, LYON, MARSHALL, MCCRACKEN, TODD & TRIGG COUNTIES:		
MILLWRIGHTS	19.05	5.37

CARP1080G 06/01/1997

	Rates	Fringes
DAVIESS, HANCOCK, HENDERSON, MCLEAN, MUHLENBERG, OHIO, UNION & WEBSTER COUNTIES:		
MILLWRIGHTS	19.40	6.67

ELEC0369I 06/01/1998

	Rates	Fringes
BUTLER, EDMONSON, LOGAN, TODD & WARREN COUNTIES:		
ELECTRICIANS	22.25	6.34

ELEC0429B 01/01/1994

	Rates	Fringes
ALLEN & SIMPSON COUNTIES:		
ELECTRICIANS	15.85	4.115

ELEC0816E 06/01/1997

	Rates	Fringes

BALLARD, CALDWELL, CALLOWAY, CARLISLE, CHRISTIAN, CRITTENDEN, FULTON (Except a 5 mile radius of City Hall in Fulton), GRAVES, HICKMAN, LIVINGSTON, LYON, MARSHALL, MCCRACKEN & TRIGG COUNTIES:

ELECTRICIANS:

Electricians	21.22	6.41
Cable Splicers	21.47	6.45

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* ELEC1701C 06/01/1998

	Rates	Fringes

DAVIESS, HANCOCK, HENDERSON, HOPKINS, MCLEAN, MUHLENBERG, OHIO, UNION & WEBSTER COUNTIES:

ELECTRICIANS:

Electricians	21.21	6.86
Heilarc Welding; & Cable Splicing	21.46	6.90

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* ELEC1925B 07/01/1998

	Rates	Fringes

FULTON COUNTY (Up to a 5 mile radius of City Hall in Fulton):

ELECTRICIANS	14.90	6.25
CABLE SPLICERS	15.40	6.26

ENGI0181X 01/01/1998

	Rates	Fringes
POWER EQUIPMENT OPERATORS:		
GROUP 1	19.55	5.90
GROUP 2	17.13	5.90
GROUP 3	17.51	5.90
GROUP 4	16.87	5.90

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1 - A-Frame Winch Truck; Auto Patrol; Backfiller; Batcher Plant; Bituminous Paver; Boom Cat; Bulldozer; Mechanic; Cableway; Carry-All Scoop; Central Compressor Plant; Clamshell; Concrete Mixer (21 cu. ft. or Over); Concrete Paver; Truck-Mounted Concrete Pump; Core Drill; Crane; Crusher Plant; Derrick; Derrick Boat; Ditching & Trenching Machine; Dragline; Elevating Grader & Loaders; Grade-All; Gurries; High Lift; Hoe-Type Machine; Hoist (Two or More Drums); Hoisting Engine (Two or More Drums); Hydrocrane; Hyster; KeCal Loader; LeTourneau; Locomotive; Mechanic Welder; Mucking Machine; Motor Scraper; Orangepeel Bucket; Piledriver; Power Blade; Pumpcrete; Push Dozer; Rock Spreader, attached to equipment; Rotary Drill; Roller (Bituminous); Scarifier; Scoopmobile; Shovel; Side Boom; Subgrader; Tailboom; Tow or Push Boat; Tower Crane (French, German & other types); Tractor Shovel; & Truck Crane

GROUP 2 - Air Compressor (Over 900 cu. ft. per min.); Bituminous Mixer; Boom Type Tamping Machine; Bull Float; Concrete Mixer (Under 21 cu. ft.); Dredge Engineer; Electric Vibrator;

Compactor/Self-Propelled Compactor; Elevator (One Drum or Buck Hoist); Elevator (When used to Hoist Building Material); Finish Machine; Firemen & Hoist (One Drum); Flexplane; Forklift (Regardless of Lift Height); Form Grader; Joint Sealing Machine; Outboard Motor Boat; Power Sweeper (Riding Type); Roller (Rock); Ross Carrier; Skid Mounted or Trailer Mounted Conrete Pump; Switchman or Brakeman; Throttle Valve Person; Tractair & Road Widening Trencher; Tractor (50 H.P. or Over); Truck Crane Oiler; Tugger; Welding Machine; Well Points; & Whirley Oiler

GROUP 3 - Greaser on Grease Facilities servicing Heavy Equipment

GROUP 4 - Bituminous Distributor; Burlap & Curing Machine; Cement Gun; Concrete Saw; Conveyor; Deckhand Oiler; Grout Pump; Hydraulic Post Driver; Hydro Seeder; Mud Jack; Oiler; Paving Joint Machine; Power Form Handling Equipment; Pump; Roller (Earth); Steerman; Tamping Machine; Tractor (Under 50 H.P.); & Vibrator

CRANES WITH BOOMS 150 ft. & Over (Including JIB) $.50 Premium

EMPLOYEES ASSIGNED TO WORK BELOW GROUND LEVEL ARE TO BE PAID 10% ABOVE BASIC WAGE RATE. THIS DOES NOT APPLY TO OPEN CUT WORK.

IRON0070G 06/01/1998

	Rates	Fringes
BUTLER COUNTY (Eastern eighth, including the Townships of Decker, Lee & Tilford);		
EDMONSON COUNTY (Northern three-fourths, including the Townships of Asphalt, Bee Spring, Brownsville, Grassland, Huff, Kyrock, Lindseyville, Mammoth Cave, Ollie, Prosperity, Rhoda, Sunfish & Sweden):		
IRONWORKERS:		
Structural; Ornamental; Reinforcing; Precast Concrete Erectors	20.26	9.32

IRON0103E 04/01/1998

	Rates	Fringes
BUTLER COUNTY (Townships of Aberdeen, Bancock, Casey, Dexterville, Dunbar, Elfie, Gilstrap, Huntsville, Logansport, Monford, Morgantown, Provo, Rochester, South Hill & Welchs Creek);		
CALDWELL COUNTY (Northeastern third, including the Township of Creswell);		
CHRISTIAN COUNTY (Northern third, including the Townships of Apex, Crofton, Kelly, Mannington & Wynns);		
CRITTENDEN COUNTY (Northeastern half, including the Townships of		

Grove, Mattoon, Repton, Shady Grove & Tribune);

MUHLENBERG COUNTY (Townships of Bavier, Beech Creek Junction, Benton, Brennen, Browder, Central City, Cleaton, Depoy, Drakesboro, Eunis, Graham, Hillside, Luzerne, Lynn City, Martwick, McNary, Millport, Moorman, Nelson, Paradise, Powderly, South Carrollton, Tarina & Weir);

DAVIESS, HANCOCK, HENDERSON, HOPKINS, MCLEAN, OHIO, UNION & WEBSTER COUNTIES:

IRONWORKERS	20.35	8.80

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* IRON0492C 11/01/1998

	Rates	Fringes

BUTLER COUNTY (Southern third, including the Townships of Boston, Berrys Lick, Dimple, Jetson, Quality, Sharer, Sugar Grove & Woodbury);

CHRISTIAN COUNTY (Eastern two-thirds, including the Townships of Bennettstown, Casky, Herndon, Hopkinsville, Howell, Masonville, Pembroke & Thompsonville);

EDMONSON COUNTY (Southern fourth, including the Townships of Chalybeate & Rocky Hill);

MUHLENBERG COUNTY (Southern eighth, including the Townships of Dunnior, Penrod & Rosewood);

ALLEN, LOGAN, SIMPSON, TODD & WARREN COUNTIES:

IRONWORKERS	16.48	5.37

IRON0782H 05/01/1998

	Rates	Fringes

CALDWELL COUNTY (Southwestern two-thirds, including the Townships of Cedar Bluff, Cider, Claxton, Cobb, Crowtown, Dulaney, Farmersville, Fredonia, McGowan, Otter Pond & Princeton);

CHRISTIAN COUNTY (Western third, Excluding the Townships of Apex, Crofton, Kelly, Mannington, Wynns, Bennettstown, Casky, Herndon, Hopkinsville, Howell, Masonville, Pembroke & Thompsonville);

CRITTENDEN COUNTY (Southwestern half, including the Townships of Crayne, Dycusburg, Frances, Marion, Mexico, Midway, Sheridan & Told);

BALLARD, CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LIVINGSTON, LYON, MARSHALL, MCCRACKEN & TRIGG COUNTIES:

IRONWORKERS:		
Projects with a total contract cost of $20,000,000.00 or above	19.40	8.81
All Other Work	18.10	7.77

LABO0189E 07/01/1998

	Rates	Fringes
LABORERS:		
GROUP 1	14.97	4.53
GROUP 2	15.22	4.53
GROUP 3	15.27	4.53
GROUP 4	15.87	4.53

LABORER CLASSIFICATIONS

GROUP 1 - Aging & Curing of Concrete; Asbestos Abatement Worker; Asphalt Plant; Asphalt; Batch Truck Dump; Carpenter Tender; Cement Mason Tender; Cleaning of Machines; Concrete; Demolition; Dredging; Drill Tender; Environmental - Nuclear, Radiation, Toxic & Hazardous Waste - Level D; Flagperson; Grade Checker; Hand Digging & Hand Back Filling; Highway Marker Placer; Landscaping, Mesh Handler & Placer; Puddler; Railroad; Rip-rap & Grouter; Right-of-Way; Sign, Guard Rail & Fence Installer; Signal Person; Sound Barrier Installer; Storm & Sanitary Sewer; Swamper; Truck Spotter & Dumper; & Wrecking of Concrete Form

GROUP 2 - Batter Board Man (Sanitary & Storm Sewer); Brickmason Tender; Mortar Mixer Operator; Burner & Welder; Bushammer; Chain Saw Operator; Concrete Saw Operator; Deckhand Scow Man; Dry Cement Handler; Environmental - Nuclear, Radiation, Toxic & Hazardous Waste - Level C; Forklift Operator for Masonary; Form Setter; Green Concrete Cutting; Hand Operated Grouter &

Grinder Machine Operator; Jackhammer; Pavement Breaker; Paving Joint Machine; Pipelayer; Plastic Pipe Fusion; Power Driven Georgia Buggy & Wheel Barrow; Power Post Hole Digger; Precast Manhole Setter; Walk-Behind Tamper; Walk-Behind Trencher; Sand Blaster; Concrete Chipper; Surface Grinder; Vibrator Operator; & Wagon Driller

GROUP 3 - Air Track Driller; Asphalt Luteman & Raker; Gunnite Nozzleman; Gunnite Operator & Mixer; Grout Pump Operator; Powderman & Blaster; Side Rail Setter; Rail Paved Ditch; Screw Operator; Tunnel (Free Air); & Water Blaster

GROUP 4 - Caisson Worker (Free Air); Cement Finisher; Environmental - Nuclear, Radiation, Toxic & Hazardous Waste - Levels A & B; Miner & Driller (Free Air); Tunnel Blaster; & Tunnel Mucker (Free Air)

PAIN0032E 07/01/1997

	Rates	Fringes
BALLARD COUNTY:		
PAINTERS:		
Bridges & Dams	22.40	5.03
All Other Work	18.10	5.03

Epoxy or Toxic; Lead-Based Paint Work - $1.50 Premium

PAIN0118C 05/01/1998

	Rates	Fringes
EDMONSON COUNTY:		
PAINTERS:		
Brush	15.57	4.00
Abrasive Blaster; Fireproofing; Lead Abatement; Spray; & Waterblasting 4000 PSI and Above	16.07	4.00

PAIN0156G 04/01/1998

	Rates	Fringes
DAVIESS, HANCOCK, HENDERSON, MCLEAN, OHIO, UNION & WEBSTER COUNTIES:		
PAINTERS:		
BRIDGES, LOCKS & DAMS:		
GROUP 1	20.65	5.18
GROUP 2	20.90	5.18
GROUP 3	21.65	5.18
GROUP 4	22.65	5.18
ALL OTHER WORK:		
GROUP 1	19.50	5.18
GROUP 2	19.75	5.18
GROUP 3	20.50	5.18
GROUP 4	21.50	5.18

PAINTER CLASSIFICATIONS

GROUP 1 - Brush & Roller

GROUP 2 - Plasterers

GROUP 3 - Spray; Sandblast; Power Tools; Waterblast; Steamcleaning; Brush & Roller of Mastics, Creosotes, Kwinch Koate & Coal Tar Epoxy

GROUP 4 - Spray of Mastics, Creosotes, Kwinch Koate & Coal Tar Epoxy

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PAIN0456D 05/01/1997

	Rates	Fringes
ALLEN, BUTLER, LOGAN, MUHLENBERG, SIMPSON, TODD & WARREN COUNTIES:		
PAINTERS:		
Brush	14.63	3.75
Spray; Sandblast; Boswain Chair or Heights over 50 feet	15.13	3.75

PAIN0500C 05/01/1998

	Rates	Fringes

CALDWELL, CALLOWAY, CARLISLE, CHRISTIAN, CRITTENDEN, FULTON, GRAVES, HICKMAN, HOPKINS, LIVINGSTON, LYON, MARSHALL, MCCRACKEN & TRIGG COUNTIES:

PAINTERS:

Bridges & Dams	19.00	4.52
All Other Work	14.75	4.52

Spray, Sandblasting & Waterblasting - units with 3500 PSI and above - $.50 premium

Work 40 ft. and above ground level - $1.00 premium

PLUM0107E 08/01/1998

	Rates	Fringes

ALLEN, BUTLER, EDMONSON, SIMPSON & WARREN COUNTIES:

PLUMBERS; GAS FITTERS:

Plumbing contracts less than $150,000.00	17.24	5.17
All Other Plumbing contracts	22.16	5.17

PLUM0184C 07/01/1998

	Rates	Fringes

BALLARD, CALDWELL, CALLOWAY, CARLISLE, CHRISTIAN, CRITTENDEN, FULTON, GRAVES, HICKMAN, LIVINGSTON, LYON, MARSHALL, MCCRACKEN & TRIGG COUNTIES:

PLUMBERS & STEAMFITTERS	22.08	6.51

PLUM0522C 08/01/1998

	Rates	Fringes

ALLEN, BUTLER, EDMONSON, SIMPSON & WARREN COUNTIES:

PIPEFITTERS & STEAMFITTERS	23.40	6.45

PLUM0633B 01/01/1998

	Rates	Fringes

DAVIESS, HANCOCK, HENDERSON, HOPKINS, LOGAN, MCLEAN, MUHLENBERG, OHIO, TODD, UNION & WEBSTER COUNTIES:

PLUMBERS & PIPEFITTERS	21.935	5.38

TEAM0089C 03/31/1998

	Rates	Fringes

TRUCK DRIVERS:

ALLEN, BUTLER, EDMONSON, LOGAN, SIMPSON & WARREN COUNTIES:

GROUP 1	15.59	7.025
GROUP 2	15.82	7.025
GROUP 3	15.89	7.025
GROUP 4	15.90	7.025

BALLARD, CALLOWAY, CALDWELL, CARLISLE, CHRISTIAN, CRITTENDEN, FULTON, GRAVES, HICKMAN, LIVINGSTON, LYON, MARSHALL, MCCRACKEN, TODD & TRIGG COUNTIES:

GROUP 1	19.74	2.95
GROUP 2	19.97	2.95
GROUP 3	20.04	2.95
GROUP 4	20.05	2.95

DAVIESS, HANCOCK, HENDERSON, HOPKINS, MCLEAN, MUHLENBERG, OHIO, UNION & WEBSTER COUNTIES:

GROUP 1	17.23	6.05
GROUP 2	17.46	6.05
GROUP 3	17.53	6.05
GROUP 4	17.54	6.05

TRUCK DRIVER CLASSIFICATIONS

GROUP 1 - Greaser, Tire Changer

GROUP 2 - Truck Mechanic

GROUP 3 - Single Axle Dump & Flatbed; Terrain Vehicle when used to haul materials; Semi-Trailer or Pole Trailer when used to pull building materials & equipment; Tandem Axle Dump; Distributor; & Mixer

GROUP 4 - Euclid, Other Heavy Earthmoving Equipment & Lowboy; Articulator Cat Truck & 5 Axle Vehicle; Winch & A-Frame when used in transporting materials; Ross Carrier; Fork Lift Truck when used to transport building materials; & Drivers on Pavement Breaker

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(v)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations

Wage and Hour Division
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

STATEMENT AND ACKNOWLEDGMENT

FORM APPROVED OMB NO
9000-0014

Public reporting burden for this collection of information is estimated to average .15 hours per response, including the time for reviewing instructions. Searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the suggestions for reducing this burden, to the FAR Secretarial (VRS), Office of Federal Acquisition and Regulatory Policy, GSA Washington, D.C. 20405: and to the Office of Management and Budget, Paperwork Reduction Project (9000-0014), Washington, D.C. 20503

PART I - STATEMENT OF PRIME CONTRACTOR

1. PRIME CONTRACT NO.	2. DATE SUBCONTRACT AWARDED	3. SUBCONTRACT NUMBER

4. PRIME CONTRACTOR (Name, address and ZIP code)	5. SUBCONTRACTOR (Name, address and ZIP code)

6. The prime contractor states that under the contract shown in item 1, a subcontract was awarded on date shown in item 2 by (Name of Awarding Firm)

to the subcontractor identified in item 5, for the following work:

7. PROJECT	8. LOCATION	
9. NAME AND TITLE OF PERSON SIGNING	10. BY (Signature)	11. DATE SIGNED

PART II - ACKNOWLEDGMENT OF SUBCONTRACTOR

12. The subcontractor acknowledges that the following clauses of the contract shown in item 1 are included in this subcontract:

Contract Work Hours and Safety Standards Act - Overtime Compensation - Construction	David-Bacon Act
Payrolls and Basic Records	Apprentices and Trainees
Withholding of Funds	Compliance with Copeland Regulations
Disputes Concerning Labor Standards	Subcontracts
	Contract Termination-Debarment
	Certification of Eligibility

13. NAME(S) OF ANY INTERMEDIATE SUBCONTRACTORS, IF ANY

14. NAME AND TITTLE OF PERSON SIGNING	15. BY (Signature)	16 DATE SIGNED

24 October 1988

(Sample of Typical contractor Quality report)

CONTRACTOR'S NAME
(Address)

DAILY CONSTRUCTION QUALITY CONTROL REPORT

Contract No:_____ Date:_____ Report No._____
Project Name_____
Weather: (Clear) (P. Cloudy) (Cloudy); Temperature: ____Min.____Max; ____Rainfall ____in.

Contractor/Subcontractors/Supplier	Area of Responsibility
a.	
b.	
c.	
d.	
e.	
f.	
g.	

1. Definable Features of Construction in Progress: (Give briefly only definable features of work in progress and location. Refer to work performed by prime and/or subcontractor and/or supplier by letter in table above).

2. Material and/or Equipment Delivered to site:

3. Results of Surveillance:

Preparatory Phase (Attach minutes):

Initial Phase (Attach minutes):

Follow-up Phase (Include satisfactory work completed and/or deficiencies with action to be taken):

4. Tests Required by Plans and/or Specification Performed and results of Test:
(Attach results of test taken on previous dates).

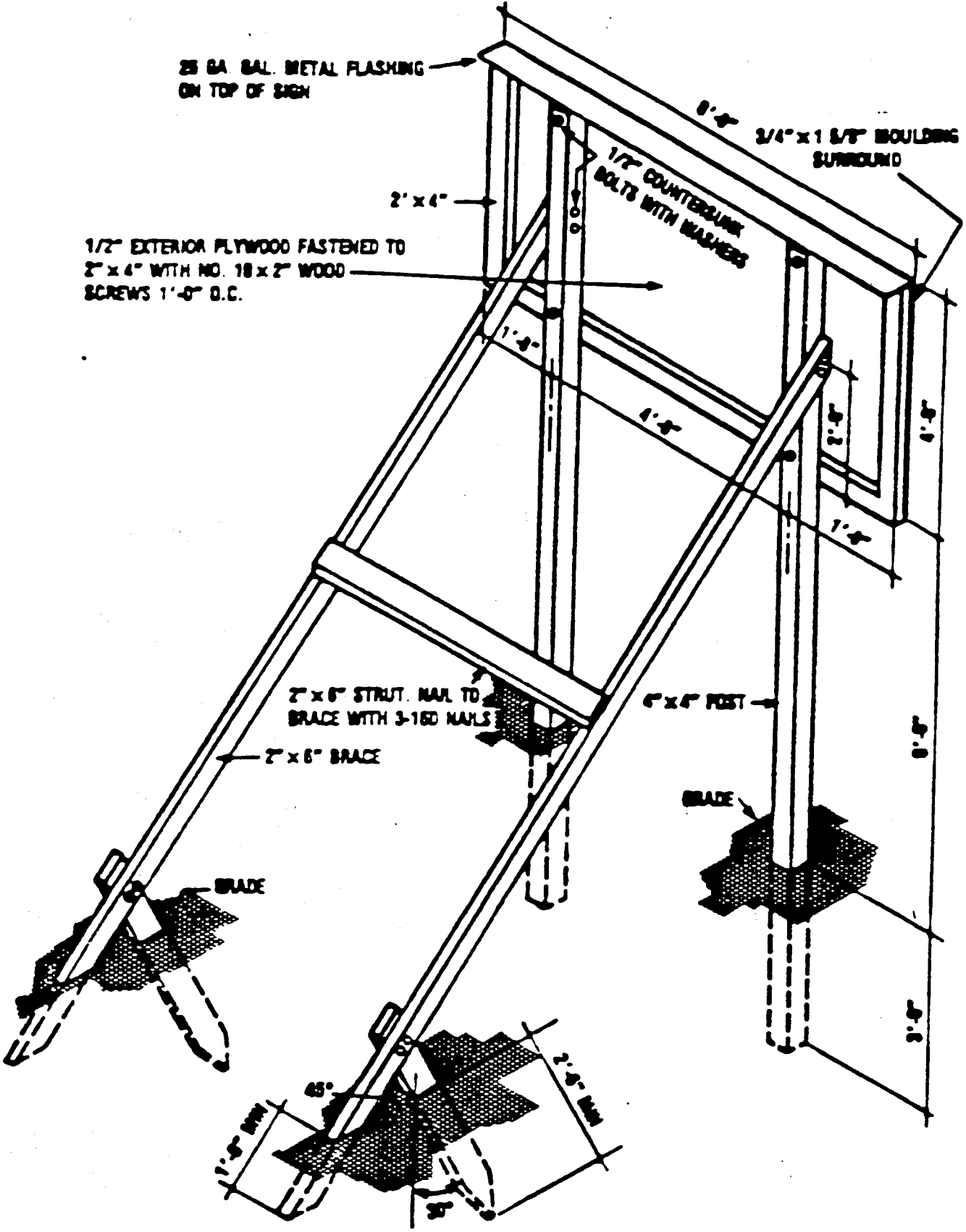
5. Verbal Instructions Received: (List any instructions given by Government Personnel on construction deficiencies. Retesting required, etc., with action to be taken.

6. Safety Deficiencies Noted. (Describe corrective actions taken).

7. Remarks: (Cover any conflicts in plans, specifications, or instruction).

CONTRACTOR'S VERIFICATION: The above report is complete and correct and all material and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications except as noted above.

Contractor's Authorized QC Representative



CONSTRUCTION SIGN ISOMETRIC
ERECTION DETAILS

All Construction Project Identification signs and Safety Performance signs are to be fabricated and installed as described below. The signs are to be erected at a location designated by the contracting officer and shall conform to the size, format, and typographic standards shown

The sign panels are to be fabricated from .75" High Density Overlay Plywood.

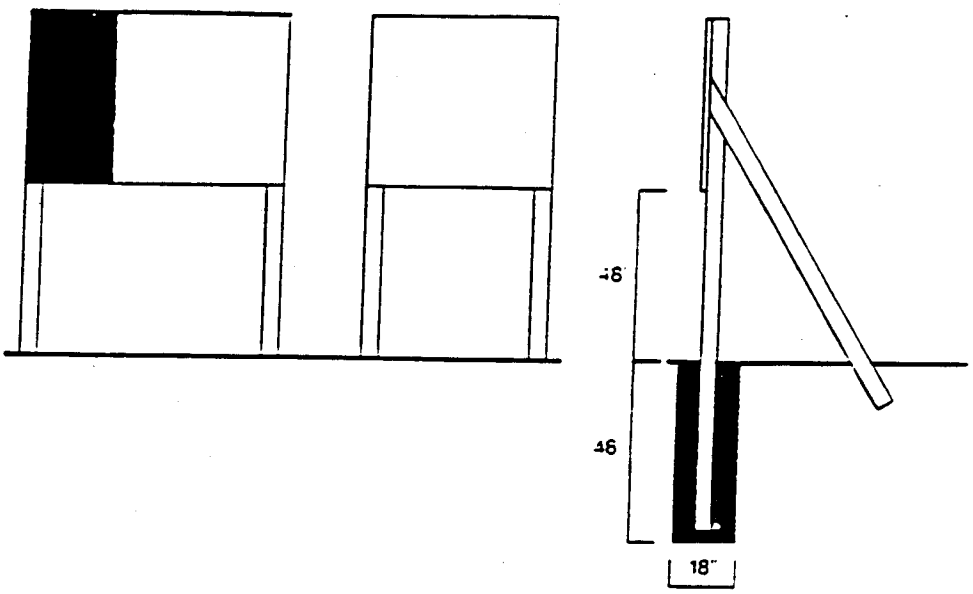
All graphics are to be applied to the background panel following the graphic formats as indicated.

Drill and insert six (6) .375" T-nuts from the front face of the HDO sign panel. Flange of T-nut to be flush with sign face.

Apply lettering and logo to prepared HDO plywood panel.

Sign uprights to be structural grade 4"x4" treated Douglas Fir or Southern Yellow Pine, No. 1 or better. Post to be 12' long. Drill six (6) .375" mounting holes in uprights to align with T-nuts in sign panel. Countersink (.5") back of hole to accept socket head cap screw (4"x.375").

Assemble sign panel and uprights. Imbed assembled sign panel and uprights in 4' hole. Bolt additional 2"x4" struts on inside face of uprights to reinforce installation as shown.



Construction Project Sign

Legend Group 1: Corps Relationship

1. _____
2. _____

Legend Group 2: Corps Signature

1. U.S. Army Corps
2. of Engineers

Legend Group 2A: District Name

1. _____
2. _____

Legend Group 3: Project Title

1. _____
2. _____
3. _____

Legend Group 4: Facility Name

1. _____
2. _____

Legend Group 5a: Designer

1. _____
2. _____
3. _____
4. _____
5. _____

Legend Group 5b: Contractor

1. _____
2. _____
3. _____
4. _____
5. _____

Introduction: Project Identification Sign

Below are two samples of the construction project identification sign showing how this panel is adaptable for use to identify either civil works projects with a local sponsor (top) or military (bottom). The graphic format for this 4' x 6' sign panel follows the legend guidelines and layout as specified below. The large 4' x 4' section of the panel on the right is to be white with black legend. For the top sign, the upper left 2' x 2' section of the sign with the full Corps signature is to be painted Communications Red with white lettering. The lower left 2' x 2' section of the sign shall match the local sponsor's colors with white lettering. For the bottom sign, the 2' x 4' left section of the sign with full Corps signature is to be painted Communications Red with white lettering. Mounting and fabrication details are provided.

Legend Group 1: One-to two-line description of Corps relationship to project.
Color: White
Typeface: 1.25" Helvetica Regular
Maximum line length: 19"

Legend Group 2: Two-line Corps Signature (US Army Corps of Engineers). Placed below Corps Castle
Color: White
Typeface: 1.5" Helvetica Bold

Legend Group 2a: District Name. Placed below Signature (6" Castle).
Color: White
Typeface: 1.25" Helvetica Regular

Legend Group 3: Words "Local Sponsor"
Color: White
Typeface: 1.25" Helvetica Regular
Maximum length: 19"

Legend Group 4: One-to-three lines for name of local sponsor
Color: White
Typeface: 1.5" Helvetica Regular

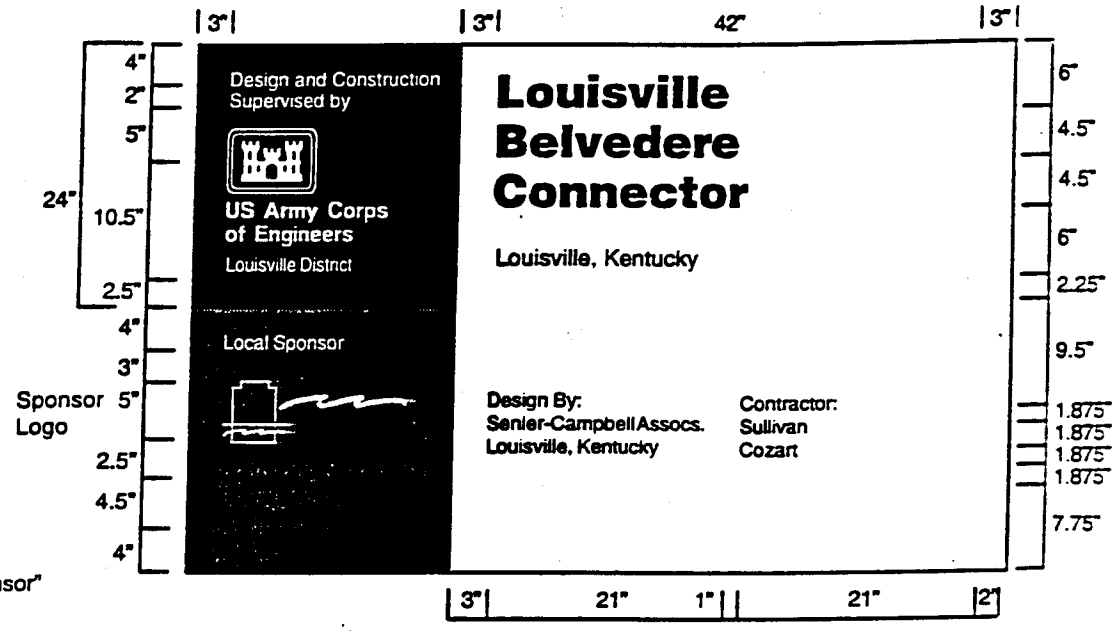
Legend Group 5: One- to three-line project title legend describes the work being done under this contract.
Color: Black
Typeface: 3" Helvetica Bold
Maximum line length: 42"

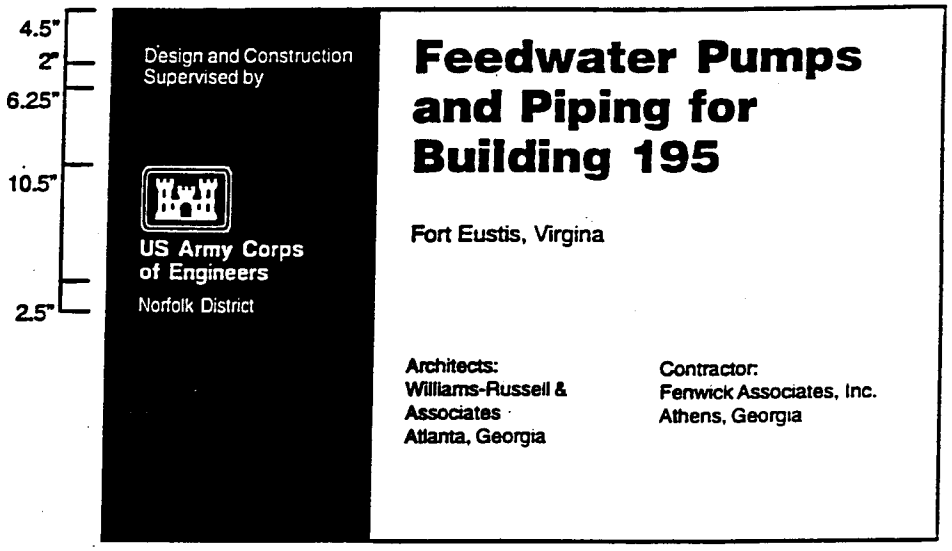
Legend Group 6: One- to two-line identification of project or facility (civil works) or name of sponsoring department (military).
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Cross-align the first line of Legend Group 5 with the first line of the Corps Signature (US Army Corps) as shown.

Legend Groups 7a-b: One- to five-line identification of prime contractors including: type (general contractor, etc.) corporate or firm name, city, state.
Color: Black
Typeface: 1.25" Helvetica Regular
Maximum line length: 21"

All typography is flush left and rag right, upper and lower case with initial capitals only as shown.





Legend Size	Panel Size	Post Size	Mounting Height	Color Bkg/Lgd
Various	4' x 6'	4" x 4"	48"	WH-RD/BK

US Army Corps of Engineers

Louisville District

SUBMITTAL REGISTER

(ER 415-1-10)

CONTRACT NO.:

TITLE AND LOCATION

CONTRACTOR:

SPECIFICATION SECTION:

ACTIVITY NO	TRANS-MITTAL NO.	ITEM NO	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL									CLASSI-FICATION		REVIEWER	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS
					DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	O&M MANUALS	INFORMATION ONLY	GOVERNMENT APPROVED		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa

ENG FORM 4288-R, JAN 97 **EDITION OF MAR 95 IS OBSOLETE.** PAGE ____ OF ____ PAGES (Proponent: CEMP-CE)

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE *(Read instructions on the reverse side prior to initiating this form)*	DATE	TRANSMITTAL NO.

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This section will be initiated by the contractor)*

TO:	FROM:	CONTRACT NO.	CHECK ONE: ☐ THIS IS A NEW TRANSMITTAL ☐ THIS IS A RESUBMITTAL OF TRANSMITTAL _____
SPECIFICATION SEC. NO. *(Cover only one section with each transmittal)*	PROJECT TITLE AND LOCATION		CHECK ONE: THIS TRANSMITTAL IS FOR FIO ☐ GOV'T ☐ APPROVAL

ITEM NO. a.	DESCRIPTION OF ITEM SUBMITTED *(Type size, model number/etc.)* b.	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. (See Instruction no. 8) c.	NO. OF COPIES d.	CONTRACT REFERENCE DOCUMENT SPEC. PARA. NO. e.	DRAWING SHEET NO. f.	FOR CONTRACTOR USE CODE g.	VARIATION (See instruction no. 6) h.	FOR CE USE CODE i.

REMARKS	I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as other wise stated NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED *(List by Item No.)*	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE

Instructions

1. Section I will be initiated by the contractor in the required number of copies.

2. Each transmittal shall be numbered consecutively in the space provided for “Transmittal No.”. This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; in resubmittals, insert transmittal number of last submission as well as the new submittal number.

3. The “Item No.” will be the same “Item No.” as indicated on ENG FORM 4288-R for each entry on this form.

5. Separate transmittal form will be used for submittals under separate section of the specifications.

6. a check shall be placed in the “Variation” column when a submittal is not in accordance with the plans and specifications—also, a written statement to that effect shall be included in the space provided for “Remarks.

7. Form is self-transmittal, letter of transmittal is not required.

8. When a sample of material or Manufacturer’s Certificate of Compliance is transmitted, indicate “Sample” or “Certificate” in column c, Section I.

9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g. to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

A – Approved as submitted.

B – Approved, except as noted on drawings.

C – Approved, except as noted on drawings. Refer to attached sheet resubmission required.

D – Will be returned by separate correspondence.

E – Disapproved (See attached).

F – Receipt acknowledged.

FX – Receipt acknowledged, does not comply as noted with contract requirements.

G – Other *(Specify)*

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

(Reverse of ENG form 4025-R)

EQUIPMENT-IN-PLACE LIST

Contract No._____

Description of Item:_____

Model No:_____

Serial No:_____

Capacity:_____

Name of Mfg:_____

Condition:_____

Checked by:_____Replacement Cost_____

Description of Item:_____

Model No:_____

Serial No:_____

Capacity:_____

Name of Mfg:_____

Condition:_____

Checked by:_____Replacement Cost_____

Description of Item:_____

Model No:_____

Serial No:_____

Capacity:_____

Name of Mfg:_____

Condition:_____

Checked by:_____Replacement Cost_____

(If Para. 10 is used, use this form)

DEFICIENCY LIST

CONTRACT NUMBER:_____ PROJECT: _____

		DEFICIENCY		CORRECTION		
DEFIC. NO.	DESCRIPTION	DATE OBSERVED	CQC REPORT NO.	DATE CORRECTED	CQC REPORT NO.	COMMENTS

SECTION 01030

METRIC MEASUREMENTS

SECTION 01030 01030-1

SECTION 01030 01030-1
1.1 REFERENCES.....01030-1
1.2 GENERAL.....01030-1
1.3 USE OF MEASUREMENTS.....01030-1
1.4 COORDINATION.....01030-2
1.5 RELATIONSHIP TO SUBMITTALS.....01030-2

SAFETY PAYS

SECTION 01030

METRIC MEASUREMENTS

09/93

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 380	(1993) Practice for Use of the International System of Units (SI)
ASTM E 621	(1984; R 1991) Practice for Use of Metric (SI) Units in Building Design and Construction

1.2 GENERAL

This project includes metric units of measurements. The metric units used are the International System of Units (SI) developed and maintained by the General Conference on Weights and Measures (CGPM); the name International System of Units and the international abbreviation SI were adopted by the 11th CGPM in 1960. In some cases both metric SI units and English inch-pound (I-P) units are included in a section of the specifications; the measurements used in any particular case have been determined by the circumstances involved. Specifications requiring metric measurements may contain requirements for equipment (e.g. printers, HVAC systems) described in I-P units; in which case no metric substitution will be allowed. Specifications requiring metric measurements may include references to related non-metric industry and/or Government standards; in which case the requirements of the standard govern. For American Society for Testing Materials (ASTM) references in the techncal specifications, the Contractor shall use the metric publication, if one is available (For example: ASTM A 36, use ASTM A 36M). An acceptable substitute to hard Metric SI Concrete Masonry Units (CMU) and Recessed Lighting Fixtures is English inch-pound (soft metric) Concrete Masonry Units (CMU) products and Recessed Lighting Fixtures. The Contractor shall be responsible for any adjustments required to accomodate these alternative English inch-pound units at no additional cost to the Government.

1.3 USE OF MEASUREMENTS

Measurements shall be either in SI or I-P units as indicated, except for soft metric measurements or as otherwise authorized. The Contractor shall be responsible for all associated labor and materials when authorized to substitute one system of units for another and for the final assembly and performance of the specified work and/or products.

1.3.1 Hard Metric

A hard metric measurement is indicated by an SI value with no expressed correlation to an I-P value (e.g. 38mm). Hard metric products are required when only metric dimensions are indicated, except for contractors options as outlined in paragraph 1.2 above. Products are considered to be hard metric when they are manufactured to metric dimensions or have an industry recognized metric designation.

1.3.2 Soft Metric

A soft metric measurement is indicated by an SI value which is a mathematical approximation of the I-P value shown in parentheses (e.g. 38.1 mm). Soft metric measurements are used for measurements pertaining to products, test values, and other situations where the I-P units are the standard for manufacture, verification, or other controlling factor. The I-P value shall govern while the metric measurement is provided for information.

1.3.3 Neutral

A neutral measurement is indicated by an identifier which has no expressed relation to either an SI or an I-P value (e.g. American Wire Gage (AWG) which indicates thickness but in itself is neither SI nor I-P).

1.4 COORDINATION

Discrepancies, such as mismatches or product unavailability, arising from use of both metric and non-metric measurements and discrepancies between the measurements in the specifications and the measurements in the drawings shall be brought to the attention of the Contracting Officer for resolution.

1.5 RELATIONSHIP TO SUBMITTALS

Submittals for Government approval or for information only shall cover the SI or I-P products actually being furnished for the project. The Contractor shall submit the required drawings and calculations in the same units used in the contract documents describing the product or requirement unless otherwise instructed or approved. The Contractor shall use ASTM E 380 and ASTM E 621 as the basis for establishing metric measurements required to be used in submittals.

--END OF SECTION--

SECTION 01080

SOURCES FOR METRIC PRODUCTS
09/9

SECTION 01080 01080-1

SECTION 01080 01080-1
1.1 REFERENCES.....01080-1

PART 2 NOT USED.....01080-15

SECTION 01080

SOURCES FOR METRIC PRODUCTS
09/97

PART 1

1.1 REFERENCES

1.1.1 Not Used

1.1.2 Air Diffusers and Grilles

Acutherm CA
Manufacturer of VAV air distribution devices, can make metric sizes.
Caroline
510-785-0510

Aireguide FL
A large air products mfr, can make 80-90% of its products in metric sizes.
Daryl Gray
305-888-1631

Carnes WI
A large mfr, often makes metric sizes.
Dick Laughlin
608-845-6411

Donco Air Products IA
Can make light troffer, slot, and lay-in diffusers up to 1500 mm long.
Ron Jansen/Marc Vanedgrift
515-488-2211

Duralast LA
Ron Vinson (distributor)
504-837-2346

J & J Register TX
Can make hard sizes.
Paul Dana
915-852-9111

Juniper Industries NY
Has made, and can make metric size diffusers and grilles.
Steve Liebermann
718-326-2546

Krueger, Ind. AZ
Can make metric sizes.
Steve Bowser
972-918-8894

Rock Island Register IL
Can make its diffuser in 600 x 600.
John Howarth

309-788-5611

Thermo Kinetics SC
Can make metric grilles and diffusers. No extra cost.
Terry Rutledge
800-268-0697

Titus Products TX
Major mfr. of grilles and diffuser products, indicates a number of products now available in metric sizes.
John Frank
972-699-1030

1.1.3 Anchor Bolts

These firms can provide metric anchor bolts, threaded rod, and similar material.

AI Nut & Bolt
Victor Villegas
800-5423-4287

Archer-Engineering IL
Ron Lanie
773-247-3501
No minimum quantity.

Atwood Industries OH
Jeff Mueller, James Mraz
800-362-2059
No minimum order. Premium on smaller quantities.

Fansteel Mfg. LA
Dick Humston
800-394-7091
Lists metric threads can be obtained on their anchor bolt products.

High Point Fasteners NJ
Ted Brace
201-293-3411
No minimum quantity.

Hilti OK
Dick Wollmenshauzser
800-879-6000
Offers their HSL metric expansion anchors in M8, M10, M12, M16, M20, and M24.

Kenneth Lilly Fasteners DE
Gary Lilly, Roland Sharp
800-433-1815
No minimum quantity.

Midstate Bolt and Screw MI
Herb Sommers, Kevin Bloss
800-482-0867

No minimum quantity.

O'Brien Iron Works CA
Richard Schulba, Richard Kotalik
510-685-5300
No minimum quantity.

Piping Technology TX
Marion McKnight, Aundrela Durham
713-731-0030
required minimum order

Richmond Screw Anchor TX
Leroy Caldwell
800-989-2700
No minimum order, premium on orders of 100 bolts or less.

Steel Products/Massillon HO
Mike Friel
800-874-2658
Minimum $50.00 order.

Wayne Bolt MI
Joe or Mike Wojcik
800-521-2207
No minimum guantity

1.1.4 Block/CMU

Many firms can supply hard metric block.

Betco Block
Is supplying metric block to GSA. Minimum order is 150 m2.

Betco Block MD, Scott Harper, 800-486-2312
Betco Block PA, Steve Nagel, 800-300-6155
Betco Block VA, Robert Carmody, 800-486-4011

Capital Industries, MI
manufacturers for Burns and Russell MD
Dick Collins
810-828-3083

Clarkes Block GA
L. E. Wells
912-234-3436

Colorado Concrete Mfg. CO
Karl Dolder, Thor Kaumeyer
719-390-5477
Paving Stone

Dagostino Building Blocks NY
Ed Carey, Jeff Orvis
518-374-3116

Featherlight Building Products TX
Wade Albritton, H. V. Moss
512-472-2424
Can produce metric block

Grand Blanc Cement MI
Michael Hicks, Ron Hunt
800-875-7500
Can supply metric molds, all shapes.

E. P. Henry NJ
Stephen Reale, Mariane Anzaldo
609-845-6200
Paving Stones

Jewell Concrete Products TX
Walter Grisham
817-772-3440
Steve Bickerdike
903-592-0752
Can make metric block.

Superlite Block AZ
Mark Yablowski
520-744-3500
Several hundred block orders acceptable.

Trenwyth Industries PA
Bill Witheron
800-233-1924
Makes many metric block sizes.

Tricon Enterprises MA
Reiner Kuntz
508-697-6112
Paving Blocks

1.1.5 Block/Glass

Pittsburgh Corning PA
Robert McMarlin
412-327-6100
Makes metric glass block. Several patterns. 190 X 190 mm (80 or 100 mm thick)

1.1.6 Carpet

Interface GA
Scott Landa, Kathy Kerby
800-336-0225
Carpet Tiles. No minimum, but premiums on orders from 1 to 100 m2 orders.

Shaw PA
Sara Jornson, 800-424-7429
Carpet Tiles.

1.1.7 Ceiling Systems

Armstrong World Industries PA
Tim Traber
717-396-6207
Usually no added cost or lead time for metric sizes.

Celotex Corporation FL
Debbie Morales
813-873-4027
A major tile Mfr, offers an entire product line of hard metric sizes.

Chicago Metallic Corp. IL
Doug Evak
800-323-7164
Makes Metric grids.

National Rolling Mills PA
Rich Mattioni
610-644-6700
Steel Ceilings OH
Lou Heil
614-622-4655
Can make metric perforated and unperforated accoustical metal ceiling panels in steel, aluminum, and stainless.
USG Interiors IL
David Vanosdall
312-606-3804

1.1.8 Conductors

These firms either have made metric conductors before, or are able to make them.

Americable AR
Noubar Sarkissian
800-643-1516
Produces mm2 sizes, and can supply for US projects, (sizes 0.5 to 300 mm2)

American Flexible Conduit MA
Mary Lou Newell
800-225-8588
Has made metric before, can produce mm2 sizes.

Pacific Electricord CA
Beverlly Kokis
310-532-6600
Stocks some 0.75, 1, and 1.5 mm2 product. Can produce other sizes.

Pirelli Cable NJ

Joe Anderson
800-845-8507
Has made mm2 sizes, and produce.

Rome Cable NY
Jan Visser
315-337-3000
Has made mm2 sizes, can produce.

1.1.9 Curtainwalls

These are obtainable in hard metric. This means panel length and width can be any size. Panel extrusions may be hard to change, and may need to be specified in soft metric.

Howard Industries, FL
Bob Voigt or Joe Sixto
815-889-4105
A major windowall mfr, has done foreign work, can make metric sizes.

Kalwell Corporation NH
Bruce Keller
800-258-9777
A major curtainwall producer, can make hard metric sizes.

Kawneer Company GA
Edward Bugg, Asst. Engrg Mgr, 540-433-2711
A major manufacturer, has been making metric fior overseas for years, and can make any metric size.

1.1.10 Doors/ Metal

Acme Steel Door NY
Joseph Licari
718-384-7800

American Steel Products NY
Hank Repperger
516-293-7100
Can make any size metric door.

Amweld Building Products, OH
Fred Bloom, Jr.
800-248-6116
Has made metric before, can make metric sizes.

Ceco Door IN + TN
Emil Kostel
615-661-5030
A major mfr, can make any hard metric size.

Dual Lock OR
Rick Carlton
800-678-0566
Major aluminum products, mfr, can make any metric size.

1.1.11 Doors/Wood

Many other door manufacturers indicated ability to supply metric doors but did not respond with detailed information prior to publication.

Eagle Plywood and Door Mfr NJ
Tony Schifano
908-769-7650
No minimum

Marlite OH
Donald Sweitzer
330-343-6621
Can produce.

Mohawk Flush Doors PA
Don Enigk
717-473-3557
No minimum.

Vancouver Door WA
Gary Geppert
206-845-9581

1.1.12 Gypsum Board

Celotex FL
Christa
813-873-4027

Georgia Pacific GA
Mohomid Ali, Mel Happel
800-225-6119

National Gypsum NC
Jim Allen
800-628-4662

Temple Inland TX
Jim Rush
800-231-6060

USG Interiors IL
Chuck Capperino
312-606-4190

1.1.13 Floor Tile

Freudenberg MA
Mike Goulette
508-689-0530

Gerbert PA
Bill Neifert
717-299-5035

Roppe OH
800-537-9527

1.1.14 Lighting Fixtures

We recommend that selection of fixtures be limited to the high volume, commonly used lay-in fixtures, since industry is concerned that the effort associated with converting all products to metric over a short period of time would be difficult, as tooling requires resources and time to construct.

ALP Lighting IL
Don Michels
773-774-9550
Supplies louvers and lenses to many major US mfrs., can produce these products in any required metric size. ALP has supplied louvers to Germany and England in metric sizes.

American Fluorescent IL
Gary Stabelfeldt
847-249-5970
Can produce the 600 x 600 and 600 x 1200 fixtures. Electronic ballasts available. Parabolic and lensed available. Minimum order is about 500 fixtures.

Bieber Lighting Corporation CA
Bob Bieber, Ron Bieber
800-243-2375 213-776-4744
Can make both 600 x 600 and 600 x 1200 hard metric fixtures. 18 cell parabolics, electronic ballasts, are available.

C. W. Cole & Co. CA
KevinBrummett
818-443-2473
Can make both 600 x 600 and 600 x 1200 hard metric light fixtures. Parabolic and lensed. Electronic ballasts are available.

Day-O-Lite Manufacturing RI
Steve weisman
401-467-8232
Can produce the 600 x 600 and 600 x 1200 fixtures. Electronic ballasts available, parabolic and lensed available. No minimum order quantity.

Hasco Electric Corp. CT
Brad Segona
203-531-9400
Can produce both the 600 x 600 and 600 x 1200 fixtures. Parabolic, lense and electronic ballasts available. Minimum order is about 20 fixtures.

Holophane OH
Dennise Lohman
614-345-9631
Can provide the 600 x 600 and 600 x 1200 fixtures. Parabolic or lensed available. Electronic ballasts available. Holophane has quoted hard metric inquiries before. Minimum order is probably about 100 fixtures.

Lithonia GA
West Coast: Marcus Cone
818-965-0711
One of the largest US lay-in mfrs, produces hard metric fixtures in its SP, SP(air), Paramax, and Optimax products.

Louisville Lamp Company KY

Mike Davidson
502-964-4094
Is able to supply both the 600 x 600 and 600 x 1200 fixture. Electronic ballasts, parabolics, lensed fixtures available. No minimum quantity.

Lumispec PA
Eric Papougenis
215-228-3830
Can produce both 600 x 600 and 600 x 1200 hard metric fixtures. Parbolics, lensed, and electronic ballasts available. Minimum order is about 30 fixtures.

Mark Lighting NJ
George Miller
800-526-6280
Has made metric fixtures before, can supply both the 600 x 600 and 600 x 1200. Minimum order is about 50 fixtures.

Morlite Equipment PA
Michele Lohder
814-774-9631

Solar Kinetics TX

972-556-2376
Is able to provide the 600 x 600 and 600 x 1200 fixtures. Electronic ballasts available.

USI/Columbia Lighting WA
Mark Johnson
509-924-7000
The second largest fluorescent fixture producer in the country, often produces hard metric sizes, can supply 600 x 600 and 600 x 1200, and can make almost any size metric fixture. Lead times would not normally exceed 8-10 weeks.

1.1.15 Lumber

Vanport Mfg. OR
Wayne Geist
503-663-4466
90% of production is in hard metric for Japanese and other export markets. Thicknesses 27-120 mm. Widths 45-360 mm.

1.1.16 Mechanical Equipment

Many major manufacturers of mechanical equipment already have metric literature on their products, are converting literature and product data to metric, or have committed to do so for US metric projects.

American Standard
Ansul Fire Protection
Aurora Pump
Baltimore Air Coil
Carrier Corporation
Central Sprinkler
Dunham-Bush
Hurst Boiler
ITT Bell Gossett
Lendis and Gyr Powers

Liebert, current catalog has metric
Loren Cook Company
Marley Cooling Tower
McQuay
Trane Company
York

1.1.17 Nuts

These firms can supply nuts for anchor bolts and common construction fasteners.

Century AL
Lynda Oakley
205-772-7300
Can supply metric nuts. $50 minimum order.

Coloc TX
Dick Ingram
903-848-8411
Can make up to M116 nuts. Many grades. $50 minimum order.

Fasteners and Metal Products MA
Tom Hatzis
617-489-0414
Can supply metric nuts.

Midwest Bolt and Supply MO
George Nudler
816-842-7880
Can supply metric nuts. $25 minimum.

North Texas Bolt & Nuts TX
John Ricard
972-647-0608
A distributor, can supply metric nuts

Quality Bolt LA
Pat McGrail
504-923-2607
Can provide orders in the $200-300 range.

Sampson Industries AZ
Brian Saxton, Christine Gruice
602-581-80822

1.1.18 Plywood

Metric plywood can now be used for items like housing, barracks, sheathing or formwork applications.

Champion International FL
Carl Capps

800-874-3240
Makes metric sheet sizes and thicknesses. Metric available for underlayment, sheathing, and sanded products. Metric concrete form panels can he ordered Minimum order is 1 truckload.

Wood International OR
Larry Cleverley
503-297-4738
Can supply 50-100 piece orders.

Murphy Plywood OR
John Murphy, Mark Gryziec
503-459-3225
Can make metric plywood.

Potlatch WA
C. D. Whitney/Mac Ryerse
509-328-0930
Has exported metric, can make metric sizes.

Roseburg Forest Products OR
Dave Adams/Kevin Barry
541-679-3311
Makes 6-19 mm thick plywood, can make metric sheets. Makes other metric wood building products. Minimum order is 1 truckload.

Stone Forest Industries, OR
Lain Osborn, Tom Clow
800-541-6906
Currently produces both metric dimensional and thickness plywood. This firm could produce about two pressloads minimum order (about 60 sheets) but premiums would apply to small orders of this size.

1.1.19 Rebar

Birmingham Steel AL
Chuck James
Stocks rebar in 10-35 mm. Minimum order is about 20 Mg, or one truckload, which can consist of different sizes, and can be shipped anywhere in the country. Facility ships rebar overseas reqularly.

Cascade Steel OR
Glen Peterson
503-472-4181 x 3307
Currently makes 10-35 mm. 45 and 55 mm might require some lead time.
When sizes are in stock, minimum order is about 20 Mg, or one truckload, which can be mixed sizes.

Florida Steel FL
Don Ballard, Don Haney
813-251-8811
Can produce A615M bar. Has production in Fl, NC, and TN.

Marion Steel OH
Gerry Lehrke, Michael Johnson
614-383-4011
Can make A615M but is not able to make 45 and 55 mm.

New Jersey Steel NJ
Gary Giovannetti, Elaine Skiba

908-721-6600

Nucor Steel UT
R. Wayne Jones
801-458-2300
Can make A615M rebar 400/500 ton minimum order.

1.1.20 Steel Plate

Metric steel plate is available from US mfrs, and is being specified in hard metric on our projects. Most firms indicated metric plate is usually not stocked, and would require some additional lead time. Many of these firms could also be consulted for hard metric sheet metal purchase.

Many firms indicated, however, that no order would be too small to supply such as an order for 5 or 10 base plates. However, premiums would apply to smaller orders. Many grades can be supplied.

Many of the firms also fabricate. We can provide data on what standard sizes of plate are being specified government projects.

Sample firms that stock thickness plate/ or are able to supply or produce it:

Accro-Met NC
Andrea Montano
800-543-4755
Can supply in 6-150 mm.

Excel Bridge Mfg. CA
Craig Vasquez
562-944-0701
Can obtain steel plate and fabricate products in any metric dimension.

Leeco Steel Products IL
Mark Dickman
800-621-4366
Stocks some A572M metric plate. Can supply size/thickness in A572M or other qrades.

Metalmart CA
Jed
800-888-7766
Has supplied metric plate. Stocks some, can supply many other thickness.

United States Steel Can provide a chart showing their standard metric plate thicknesses (6-160 mm). They indicate their mill prices are generally the same as their prices for equivalent English sizes.

1.1.21 Structural Bolts

Many firms can produce A325M/M164M, and A490M/M253M bolts. Some can make ASTM A394M, qalvanized metric transmission tower bolts.

Metric bolts may now be utilized on all projects.
Some firms indicated they could supply metric bolts at small quantities, but premiums primarily related to set up costs, would be associated.

Atwood Industries OH
James Mraz
800-362-2059
Can supply A325M and A490M, as well as other metric bolts.

Bennett Bolt Works NY
Ron Merrill NY, 315-689-3981
Vince Ruggerio OH, 216-979-9813

Detroit Heading MI
Roger Palmer, Kevin Stanisz
313-925-8138
Can also make A394M.

Haydon Bolts PA
Richard Guisti
215-537-8700

Holo-Chrome CT
Skip Gallo

Huck Int'l TX
Larry Chipman, Chuck Schultz
800-388-4825
Makes A325M and A49OM product.

Kenneth Lilly Fasteners DE
Gary Lilly, Roland Sharp
800-433-1818
Can supply A325M and A49OM.

Lake Erie Screw OH
Steve Vass
216-521-1800

Metric and Multistandard Components NY
Craig Worster
800-431-2792
Can supply A325M and A490M bolts. Also supplies other metric bolts.

Mid-West Fabricating OH
Vaughn Doss
614-969-4411

National Bolt NY
M. D. Strauss
800-992-6587
Minimum order is 500 bolts.

Nucor Fastener Div IN
Jim Witucky
800-955-6826
Minimum order is one keg per size.

Ohio Rod Products IN
Jay Whitehead

812-689-6565

AI Nut & Bolt CA
Luke Sullivan
800-423-4287
Is able to make metric bolts.

United Steel and Fasteners IL
Perri Guerino, Bob Fiorio
630-250-0900
No minimum quantity. Premium on smaller orders.

Wayne Bolt MI
Joe or Mike Wojcik
800-521-2207
No minimum quantity.

1.1.22 Tools

Metric tape measures are available.

Some construction firms are using metric only tapes.

Federal agencies can buy 10 ft/3.3 m tape measures on GSA schedule.
Product # 5210-00-4988, under $5.

Lufkin Tools NC
919-362-7511
Makes metric tape measures.

Stanley Tools FL
312-286-7330
Makes metric measures
32-156 (5 m) 32-158 (5m/16')
33-443 (10 m) 33-428 (7.5 m/25')
Carl Lickwar, Alan G. Martin 203-225-5111

Metric framing squares have also been ordered from Stanley by the US Public Health Service.

Stanley Hand Tools CT
800-262-2161

US Tape VA W. S. Spotswood 703-256-1500 Makes metric tape measures, steel tapes, and derrick tapes.

Scales. Metric scales are available:

Staedtler-Mars Model 987-18-1
Alvin Model 117 PM Charvoz Model 30-1261

Contact your local graphic arts supply store to order.
1.1.23 Windows

Alenco Commercial Group TX
Ed Lund
409-823-6557

Andersen Windows Commercial Group MN
Craig Johnson
612-439-5150

Modu-Line Windows WI
Mike Capo
715-842-9110

Marvin Windows MN
John Schrack
800-821-8390218-386-1430

Pella Windows IA
Cheryl Waits
515-628-1000
Can make any metric size.

PART 2 NOT USED

PART 3 NOT USED.

-- End of Section --

SAFETY PAYS

SECTION 01090

SOURCES FOR REFERENCE PUBLICATIONS
12/95

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the sponsoring organization, e.g. UL 1 (1993; Rev thru Jan 1995) Flexible Metal Conduit. However, when the sponsoring organization has not assigned a number to a document, an identifying number has been assigned for convenience, e.g. UL's unnumbered 1996 edition of their Building Materials Directory is identified as UL-01 (1996) Building Materials Directory. The sponsoring organization number (UL 1) can be distinguished from an assigned identifying number (UL-1) by the dash mark (-).

1.2 ORDERING INFORMATION

The addresses of the organizations whose publications are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the sponsoring organization should be ordered from the source by title rather than by number.

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Fax: 703-528-3816

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Fax: 312-201-0214

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Arlington Heights, IL 60004-1893
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Fax: 708-253-0088

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Fax: 703-222-2410

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Birmingham, AL 35244
Ph: 205-988-9870
Fax: 205-988-9822

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--END OF SECTION--

SECTION 01320

PROJECT SCHEDULE

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*** SAFETY PAYS ***

SECTION 01320

PROJECT SCHEDULE

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Schedules

Initial Project Schedule; GA.

Preliminary Project Schedule; FIO.

Periodic Schedule Updates; GA.

Three copies of the schedules showing codes, values, categories, numbers, items, etc., as required.

SD-08 Statements

Qualifications; FIO.

Documentation showing qualifications of personnel preparing schedule reports.

SD-09 Reports

Narrative Report; FIO.

Schedule Reports; FIO.

Three copies of the reports showing numbers, descriptions, dates, float, starts, finishes, durations, sequences, etc., as required.

1.2 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports. This person shall have previously created and reviewed computerized schedules. Qualifications of this individual shall be submitted to the Contracting Officer for review with the Preliminary Project Schedule submission.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

Pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS, a Project Schedule as described below shall be prepared. The scheduling of construction shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the project shall also contribute in developing and maintaining an accurate Project Schedule. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.

3.2 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel shall result in an inability of the Contracting Officer to evaluate Contractor progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the disapproval of the entire Project Schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, then the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made.

3.3 PROJECT SCHEDULE

The computer software system utilized by the Contractor to produce the Project Schedule shall be capable of providing all requirements of this specification. Failure of the Contractor to meet the requirements of this specification shall result in the disapproval of the schedule. Manual methods used to produce any required information shall require approval by the Contracting Officer.

3.3.1 Use of the Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The Contractor shall provide the Project Schedule in either the Precedence Diagram Method (PDM) or the Arrow Diagram Method (ADM).

3.3.2 Level of Detail Required

With the exception of the initial and preliminary schedule submission, the Project Schedule shall include an appropriate level of detail. Failure to develop or update the Project Schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the schedule. The Contracting Officer will use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the Project Schedule.

3.3.2.1 Activity Durations

Contractor submissions shall follow the direction of the Contracting Officer regarding reasonable activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods (usually less than 2 percent of all non-procurement activities' Original Durations shall be greater than 20 days).

3.3.2.2 Procurement Activities

Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing.

3.3.2.3 Government Activities

Government and other agency activities that could impact progress shall be shown. These activities include, but are not limited to: approvals, inspections, utility tie-in, Government Furnished Equipment (GFE) and notice to proceed for phasing requirements.

3.3.2.4 Workers Per Day

All activities shall have an estimate of the average number of workers per day that are expected to be used during the execution of the activity. If no workers are required for an activity, in the case of activities related to

procurement, for example, then the activity shall be identified as using zero workers per day. The workers per day information for each activity shall be identified by the Workers Per Day Code.

3.3.2.5 Responsibility

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, contractor work force, or government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

3.3.2.6 Work Areas

All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

3.3.2.7 Modification or Claim Number

Any activity that is added or changed by contract modification or used to justify claimed time shall be identified by a mod or claim code that changed the activity. Activities shall not belong to more than one modification or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number.

3.3.2.8 Bid Item

All activities shall be identified in the project schedule by the Bid Item to which the activity belongs. An activity shall not contain work in more than one bid item. the bid item for each appropriate activity shall be identified by the Bid Item Code.

3.3.2.9 Phase of Work

All activities shall be identified in the project schedule by the phases of work in which the activity occurs. Activities shall not contain work in more than one phase of work. The project phase of each activity shall be by the unique Phase of Work Code.

3.3.2.10 Category of Work

All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers, but is not limited, to the procurement chain of activities including such items as submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work Code.

3.3.2.11 Feature of Work

All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to a work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work Code.

3.3.3 Scheduled Project Completion

The schedule interval shall extend from notice-to-proceed to the contract completion date.

3.3.3.1 Project Start Date

The schedule shall start no earlier than the date that the Notice to Proceed (NTP) was acknowledged. The Contractor shall include as the first activity in the project schedule an activity called "Start Project". The "Start Project" activity shall have: a "ES" constraint, a constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

3.3.3.2 Constraint of Last Activity

Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity call "End Project". The "End Project" activity shall have: a "LF" constraint, a constraint date equal to the completion date for the project, and a zero day duration.

3.3.3.3 Early Project Completion

In the event the project schedule shows completion of the project prior to the contract completion date, the Contractor shall identify those activities that have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. Contractor shall specifically address each of the activities noted at every project schedule update period to assist the Contracting Officer in evaluating the Contractor's ability to actually complete prior to the contract period.

3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.

3.3.4.1 Start Phase

The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have: a "ES" constraint, a constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

3.3.4.2 End Phase

The Contractor shall include as the last activity in a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have: a "LF" constraint, a constraint date equal to the completion date for the project, and a zero day duration.

3.3.4.3 Phase X

The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" activity shall be logically tied to the earliest and latest activities in the phase.

3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in-progress or completed activity and Ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes.

3.3.6 Out-of-Sequence Progress

Activities that have posted progress without predecessors being completed (Out-of-Sequence Progress) will be allowed only on a case-by-case approval of the Contracting Officer. The Contracting Officer may direct that changes in schedule logic be made to correct any or all out-of-sequence work.

3.3.7 Extended Non-Work Periods

Designation of Holidays to account for non-work periods of over 5 days will not be allowed. Non-work periods of over 5 days shall be identified by addition of activities that represent the delays. Modifications to the logic of the project schedule shall be made to link those activities that may have been impacted by the delays to the newly added delay activities.

3.3.8 Negative Lags

Lag durations contained in the project schedule shall not have a negative value.

3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data disk, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

3.4.1 Preliminary Project Schedule Submission

The Preliminary Project Schedule, defining the Contractor's planned operations for the first 60 calendar days shall be submitted for approval within 20 calendar days after Notice to Proceed is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed 60 calendar days after Notice to Proceed.

3.4.2 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 40 calendar days after Notice to Proceed. The schedule shall provide a reasonable sequence of activities which represent work through the entire project and shall be at a reasonable level of detail.

3.4.3 Periodic Schedule Updates

Based on the result of progress meetings, specified in "Periodic Progress Meetings," the Contractor shall submit periodic schedule updates. These submissions shall enable the Contracting Officer or to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgement of the Contracting Officer or authorized representative, is necessary for verifying the contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

3.4.4 Standard Activity Coding Dictionary

The Contractor shall submit, with the Initial Project Schedule, a coding scheme that shall be used throughout the project for all activity codes contained in the schedule. The coding scheme submitted shall list the values for each activity code category and translate those values into project specific designations. For example, a Responsibility Code Value, "ELE", may be identified as "Electrical Subcontractor." Activity code values shall represent the same information throughout the duration of the contract. Once approved with the Initial Project Schedule submission, changes to the activity coding scheme must be approved by the Contracting Officer.

3.5 SUBMISSION REQUIREMENTS

The following items shall be submitted by the Contractor for the initial submission, and every periodic project schedule update throughout the life of the project:

3.5.1 Data Disks

Three data disks containing the project schedule shall be provided. Data on the disks shall be in the format specified in by the Contracting Officer.

3.5.1.1 File Medium

Required data shall be submitted on 3.5 disks, formatted to hold 1.44 MB of data, under the MS-DOS Version 5.0 operating system.

3.5.1.2 Disk Label

A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number or person responsible for the schedule, and the MS-DOS version used to format the disk.

3.5.1.3 File Name

Each file submitted shall have a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will ensure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for approval.

3.5.2 Narrative Report

A Narrative Report shall be provided with each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the 4 most critical paths, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken.

3.5.3 Approved Changes Verification

Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

3.5.4 Schedule Reports

The format for each activity for the schedule reports listed below shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float. Actual Start and Actual Finish Dates shall be printed for those activities in progress or completed.

3.5.4.1 Activity Report

A list of all activities sorted according to activity number or "I-NODE" AND "J-NODE" and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.

3.5.4.2 Logic Report

A list of Preceding and Succeeding activities for every activity in ascending order by activity number and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.

3.5.4.3 Total Float Report

A list of all activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates.

3.5.4.4 Earnings Report

A compilation of the Contractor's Total Earnings on the project from the Notice to Proceed until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements

made in the field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by bid item and sorted by activity numbers. This report shall: sum all activities in a bid item and provide a bid item percent; and complete and sum all bid items to provide a total project percent complete. The printed report shall contain, for each activity: Activity Number or "i-node" and "j-node", Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), Earnings to Date.

3.5.5 Network Diagram

The network diagram shall be required on the initial schedule submission and on monthly or quarterly schedule update submissions. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity or event number, description, duration, and estimated earned value shall be shown on the diagram.

3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.5.3 Critical Path

The critical path shall be clearly shown.

3.5.5.4 Banding

Activities shall be grouped to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

3.5.5.5 S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

3.6 PERIODIC PROGRESS MEETINGS

Progress meetings to discuss payment shall include a monthly onsite meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor shall describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project. The Contracting Officer will approve activity progress, proposed revisions, and adjustments as appropriate.

3.6.1 Meeting Attendance

The Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

3.6.2 Update Submission Following Progress Meeting

A complete update of the project schedule containing all approved progress, revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than 4 working days after the monthly progress meeting.

3.6.3 Progress Meeting Contents

Update information, including Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost-to-Date shall be subject to the approval of the Contracting Officer. The following minimum set of items which the Contractor shall address, on an activity by activity basis, during each progress meeting.

3.6.3.1 Start and Finish Dates

The Actual Start and Actual Finish dates for each activity currently in-progress or completed activities.

3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations must be based on Remaining Duration for each activity.

3.6.3.3 Cost Completion

The earnings for each activity started. Payment will be based on earnings for each in-progress or completed activity. Payment for individual activities will not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

3.6.3.4 Logic Changes

All logic changes pertaining to Notice to Proceed on change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, lag durations, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

3.6.3.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities include: 1) delays beyond the Contractor's control, such as strikes and unusual weather. 2) delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning the work necessary, and 3) a schedule which does not represent the actual prosecution and progress of the work.

3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor requests an extension of the contract completion date, he shall furnish such justification, project schedule data and supporting evidence as the Contracting Officer may deem necessary for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

3.7.1 Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request. The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, will not be a cause for a time extension to the contract completion date.

3.7.2 Submission Requirements

The Contractor shall submit a justification for each request for a change in the contract completion date of under 2 weeks based upon the most recent schedule update at the time of the Notice to Proceed or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

a. A list of affected activities, with their associated project schedule activity number.

b. A brief explanation of the causes of the change.

c. An analysis of the overall impact of the changes proposed.

d. A sub-network of the affected area.

Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

3.7.3 Additional Submission Requirements

For any requested time extension of over 2 weeks, the Contracting Officer may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within 4 days of the Contracting Officer's request.

3.8 DIRECTED CHANGES

If Notice to Proceed (NTP) is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The proposed revisions to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, the Contractor shall advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

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			PAR. NO. 1.1 SUBMITTALS										
			SD-07 Schedules										
		1	Initial Project Schedule; GA.										
		2	Periodic Schedule Updates; GA.										
			SD-08 Statements										
			SD-09 Reports										
		3	Narrative Report; FIO.										
		4	Schedule Reports; FIO.										

***** SAFETY PAYS *****

SECTION 01330

SUBMITTAL PROCEDURES

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*** SAFETY PAYS ***

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUBMITTAL IDENTIFICATION

Submittals required are identified by SD numbers as follows:

SD-01 Data
Submittals which provide calculations, descriptions, or documentation regarding the work.

SD-04 Drawings
Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work.

SD-06 Instructions
Preprinted material describing installation of a product, system or material, including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

SD-07 Schedules
Tabular lists showing location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

SD-08 Statements
A document, required of the Contractor, or through the Contractor, from a supplier, installer, manufacturer, or other lower tier Contractor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

SD-09 Reports
Reports of inspections or tests, including analysis and interpretation of test results.

SD-13 Certificates
Statement signed by an official authorized to certify on behalf of the manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of the contract, must state the Contractor's name and address, must name the project and location, and must list the specific requirements which are being certified.

SD-14 Samples
Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

SD-18 Records
Documentation to record compliance with technical or administrative requirements.

SD-19 Operation and Maintenance Manuals
Data which forms a part of an operation and maintenance manual.

1.2 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.2.1 Government Approved

Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.2.2 Information Only

All submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.3 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the CQC requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.4 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1.5 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

1.6 MEASUREMENT AND PAYMENT

No separate payment shall be made for shop drawings/submittals preparation and submission. Shop drawings and submital shall be considered incidental to the work specified and performed.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) representative and each item shall be stamped, signed, and dated by the CQC representative indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work

shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

3.2 SUBMITTAL REGISTER (ENG FORM 4288)

At the end of each section is one set of ENG Form 4288 listing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. The Contractor will also be given the submittal register as a diskette containing the computerized ENG Form 4288 and instructions on the use of the diskette. Columns "d" through "r" have been completed by the Government; the Contractor shall complete columns "a" and "s" through "u" and submit the forms (hard copy plus associated electronic file) to the Contracting Officer for approval within 30 calendar days after Notice to Proceed. The Contractor shall keep this diskette up-to-date and shall submit it to the Government together with the monthly payment request. The approved submittal register will become the scheduling document and will be used to control submittals throughout the life of the contract. The submittal register and the progress schedules shall be coordinated.

3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 30 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals. An additional 30 calendar days shall be allowed and shown on the register for review and approval of submittals for food service equipment, refrigeration and HVAC control systems.

3.4 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) attached to this section shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

3.5.1 Procedures

The Contractor shall submit to the Contracting Officer six (6) copies of all submittals of items coded “a”, “s”, or "U" requiring government approval, six (6) copies of all O&M manuals, and three (3) copies of all information only submittals as called for under the various headings of these specifications. Three (3) copies of government approved submittals will be returned to the contractor with government actions noted. The contractor will not normally receive a return copy of any O&M manuals or FIO submittals unless disapproved by the contracting officer.

3.5.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

3.6 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3.7 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. Three copies of the submittal will be retained by the Contracting Officer and three copies of the submittal will be returned to the Contractor.

3.8 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

3.9 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

```
_____________________________________________________________________
|                    CONTRACTOR                    |
|                                                  |
|                    (Firm Name)                   |
|                                                  |
|                                                  |
|                                                  |
| _____ Approved                                   |
|                                                  |
|                                                  |
| _____ Approved with corrections as noted on submittal data and/or  |
| attached sheets(s).                              |
|                                                  |
|                                                  |
|                                                  |
| SIGNATURE: ____________________________________________________ |
|                                                  |
| TITLE: ________________________________________________________ |
|                                                  |
| DATE: __________________________________________________________ |
|                                                  |
|__________________________________________________________________|
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SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 01330
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT NO. a.	TRANSMITTA NO. b.	ITE NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REVIEWER r.	SUBMI s.	APPROV NEEDED BY t.	MATER NEEDE BY u.	CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO.										
			SD-01 Data										
			SD-04 Drawings										
			SD-06 Instructions										
			SD-07 Schedules										
			SD-08 Statements										
			SD-09 Reports										
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			SD-14 Samples										
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***** SAFETY PAYS *****

SAFETY PAYS

SECTION 01410

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3.11 PAYMENT 01410-12

SECTION 01410

ENVIRONMENTAL PROTECTION
10/97

PART 1 GENERAL

1.1 SUMMARY (Not Applicable)

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.2.1 SD-08 Statements

Work Plans; GA.

1.2.1.1 Environment Protection

Prior to commencement of work at the site, the Contractor will submit within 10 calender days after Notice to Proceed, his written detailed proposal for implementing the requirements for environmental pollution control specified herein. The contractor will then meet the representatives of the Contracting Officer upon their completion of review of his proposal as needed for compliance with the environmental pollution control program.

1.2.1.2 Preconstruction Survey

Prior to start of any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey, after which the Contractor shall prepare a brief report indicating on a layout plan the condition of trees, shrubs, and grassed areas immediately adjacent to the site of the work and adjacent to his assigned storage area and access routes(s) as applicable. This report will be signed by both the Contracting Officer and Contractor upon mutual agreement as to its accuracy and completeness.

1.2.1.3 Waste Disposal Scheme

As part of his proposed implementation under Paragraph 3.2, and prior to onsite construction, the Contractor shall submit a description of his scheme for disposing of waste materials resulting from the work under this contract. If any waste material is dumped in unauthorized areas, the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed areas. Where directed, contaminated ground shall be excavated, disposed of as approved, and replaced with suitable fill material, all at the expense of the Contractor.

PART 2 POLLUTION PREVENTION PLANS

2.1 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with all Federal, State, and local regulations.

2.1.1 Environmental Protection Plan

The contractor will develop a site specific Environmental Protection Plan which will address in detail the following:

a. Hazardous materials (HM) to be brought onto the post:

Any hazardous materials planned or used on the post will be included in the post Hazardous Materials Tracking Program maintained by the Safety Department. A hazardous material as per 29 CFR 1910.1200 is any material which is a physical or health hazard. The Contractor shall complete the FT CAMPBELL HAZMAT inventory form which appears as an appendix to this section. The inventory form requires a list (including quantities) of HM to be brought to the post and copies of the corresponding material safety sheets (MSDS). The completed form shall be submitted to the Contracting Office representative and to Fort Campbell DPW Environmental - Pollution Prevention Branch. In the event the usage of additional Hazardous Materials are found necessary during the project, they will be included into the MSDS package of the Environmental Protection Plan. At project completion, any hazardous material brought onto the post shall be removed from the site by the Contractor. As required by the Emergency Planning and Community Right - to - Know Act (EPCRA), the Contractor will account for the quantity of HM brought to the post, the quantity used or expended during the job, and the leftover quantity which (1) may have additional useful life as HM and shall be removed by the Contractor, or (2) may be hazardous waste, which shall then be removed as specified herein. This information will be provided on an annual basis.

b. Hazardous waste (HW) generated:

The Environmental Protection Plan must list, quantify explain how any HW generated during the project will be disposed. Disposal of hazardous waste generated by the contractor shall be disposed off site according to applicable regulations at the contractor's expense. A report must be submitted annually of the generation of hazardous waste on post and must be provided to the Contracting Officer representative and to DPW Environmental - Pollution Prevention Branch.

c. Storage of hazardous waste:

In accordance with post regulations and 40 CFR 262, hazardous waste shall be stored near the point of generation up to a total quantity of (one quart) 1 L of acutely hazardous waste or (55 gallons) 200 L of hazardous waste (Satellite Accumulation Point). Any volume exceeding these quantities shall be moved to a HW permitted area within 3 days. Locations of hazardous waste storage areas must be approved by DPW-ED-PP. Containers must be labeled in accordance with 40 CFR 262 and must contain the words Hazardous Waste or other words which identify the contents of the container. Prior to shipment of hazardous waste on site or off, the waste must be placed into good condition Department of Transportation (DOT) specification containers for hazardous waste (49 CFR 172.101). The area selected for the storage of hazardous wastes must minimize the threat to human health or the environment in the event of a release.

d. Minimization of hazardous waste:

In accordance with post regulations, the Contractor should substitute materials as necessary to reduce the generation of HW and include a statement to that effect in the Environmental Plan.

e. Environmental conditions likely to be encountered during this project:

Contact the Contracting officer for conditions in the area of the project which may be subject to special environmental procedures. Include this information in the Preconstruction Survey. Describe in the Environmental Plan any permits required prior to working the area, and contingency plans in case an unexpected environmental condition is discovered.

f. Permitting plans for any transportation and disposal, excavation, or construction of hazardous waste that will require an environmental permit from an issuing agency:

The Contractor is responsible for generating the permits and delivering the completed documents to the Contracting Officer. The Contracting Officer will review the permits and the Contractor shall file the documents with the appropriate agency and complete disposal with the approval of the Contracting Officer. Correspondence with the State concerning the environmental permits and completed permits shall be delivered to the Contracting Officer.

g. Radon mitigation design and testing

All non residential construction performed at Fort Campbell must have radon mitigation features implemented into the design. The contractor will install preliminary features as per drawings. The contractor will hire an independent testing company to perform radon monitoring prior to inhabitation of the units. The firm must be EPA accredited and approved to perform work in the State of Kentucky. A list of accredited testing firms in the state of Ky can be obtained through the state Radon Program Coordinator. In the event radon concentrations greater than 4 pCi/l (pico curies per liter) are revealed consult Fort Campbell DPW through the Contracting Officer's representative for guidance pertaining to retesting. If upon further testing unacceptable levels are present, additional mitigation features will be installed followed by more testing. The buildings will not be inhabited until levels of less than 4 pCi/l have been achieved.

2.1.1.1 Environmental Protection Plan Format

The Environmental Protection Plan shall follow the following format:

1. Hazardous materials to be brought onto the post
2. MSDS package
3. Employee training documentation
4. HW storage plan
5. HW to be generated
6. Preconstruction survey results
7. Permitting requirements identified
8. Waste Disposal Plan
9. Site Specific Spill Contingency Plan

2.1.1.2 Environmental Plan Review

Fourteen days after the environmental protection meeting, submit to the Contracting Officer the proposed environmental plan for further discussion, review, and approval.

2.1.1.3 Commencement of the Work

As directed by the Contracting Officer, following approval.

2.1.2 Storm Water Pollution Prevention Plan

The following Pollution Prevention Plan is incorporated into the contract documents as a portion of the construction activities to be undertaken by the Contractor. The plan as outlined below contains the minimum requirements for the work under this contract.

POLLUTION PREVENTION PLAN FOR
DISCOM BARRACKS COMPLEX

The purpose of this plan is to detail the controls that will be utilized for this construction in order to control sediment in the storm water runoff from the construction site drainage area.

Project Location: Fort Campbell, Kentucky
PN 33901

Description of Site and Construction Activity: This construction will consist of constructing (3) new buildings, access drives, grading, utilities development with parking areas.

The soil disturbing activity will consist of clearing and grubbing and demolition for the installation of the erosion and sediment control features, grade work, excavation for utilities, and parking lots. The sediment and erosion controls being utilized include straw bale dam, basket curb inlet, stone outlet sediment trap, fabric drop inlet protection, gravel donut inlet protection, construction entrance/exit, silt fence, and silt fence rock overflow, and temporary seeding and mulching. Clearing and grubbing must be held to a minimum necessary for grading and equipment operation.

Temporary seeding and mulching shall be deemed necessary if no construction activity occurs in the disturbed areas for more than fourteen (14) days. Construction must be sequenced to minimize the exposure time of cleared surface areas. Grading activities must be avoided during periods of highly erosive rainfall. Slopes of 2H:1V will be protected using and erosion control blanket. Other slopes that maybe seeded and mulched may experience washout problems and require the use of an erosion control blanket. Contractor is to refer to manufacturer's recommendations for the type of erosion control blanket to be used on particular slopes.

Runoff Coefficient: The present runoff coefficient for the site is approximately 0.6 to 0.75. The development of the site will not significantly increase this coefficient. Developed coefficient is approximately 0.8.

Receiving Waters: The water for the disturbed areas will pass through erosion control then into the storm system. The storm system for the majority of the site empties into the storm system.

Controls: Erosion and Sediment Controls

STABILIZATION PRACTICES	STRUCTURAL PRACTICES
Permanent Seeding	Straw Bale Dam
Mulching	Basket Curb Inlet
	Stone Outlet Sediment
	Trap
	Fabric Drop Inlet
	Protection
	Gravel Donut Inlet
	Protection
	Temporary Construction
	Entrance/Exit
	Silt Fence

	Silt Fence Rock Overflow

2.2 ANTICIPATED SEQUENCE OF ACTIVITY:

Place erosion control measures in locations in close proximity to those shown on the drawings. Additional erosion control measures may be required to comply with the NPDES permit once demolition and construction begins.

Surface water flowing toward the construction area will be diverted around the construction area to reduce its erosion potential. Silt fence, sediment traps or straw bale check dams shall be properly constructed to detain runoff and trap sediment.

Construct new site amenities including utilities, buildings, parking areas, and sidewalks after completing the necessary demolition.

Landscape and grade remaining areas according to the drawings.

Upon completion, remove any temporary measures not necessary for future phases of the project after stabilization of the area. Any sediment removed from these measures shall be disposed of at a time and location designated by the Contracting Officer. Any other areas disturbed during the removal of the sediment control structures shall be seeded and mulched within 24 hours.
NOTE: The Contractor controls the actual sequence, however, the sediment control measures must be established prior to initiation of work in any area. Contractor for both sites will be required to coordinate this work and interface Pollution Prevention Plans to ensure compliance with the intent of the Pollution Control Plans and to maintain continuous pollution prevention. Construction should be staged or phased for this project. Stabilization shall be accomplished by temporarily or permanently protecting the disturbed soil surface from rain fall impacts and runoff.

2.3 DEMONSTRATION OF COMPLIANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.

All activities constructed under this contract will be performed in accordance with Federal, State and Local regulations. The construction contractors specifications require compliance with all applicable regulations.

2.4 POLLUTION PREVENTION PLAN AND NOTICE OF INTENT

The Contractor will implement the Pollution Prevention Plan (PPP) as shown on the plans and directed in these specifications. This plan must be implemented in accordance with the NPDES permit. A Notice of Intent (NOI) has been prepared by the U.S. Army Corps of Engineers and submitted to the state of Kentucky prior to the notice to proceed being issued. The NOI Contractor Consent form must be signed by the Contractor. A blank form is attached at the end of this section. The Contractor shall maintain a copy of the PPP in their construction trailer. Any changes made to the plan must be documented and approved by the Contracting Officer.

2.5 INVENTORY FOR POLLUTION PREVENTION PLAN

The materials or substances listed below are expected to be present onsite during construction:
These are examples of materials that could be Hazardous Materials and an inventory must be kept using Ft. Campbell Hazardous Material Form attached. This list is not comprehensive but for illustration only. The Contractor must maintain and update his Hazardous Material list and inventory forms.

Concrete Fertilizer	Detergents	Paints (Enamel and Latex)	
Cleaning Solvents	Wood	Sealants	Metal Rebar/Structural Steel
Concrete Additives	Tar	Asphalt	Petroleum Based Products

2.6 SPILL PREVENTION

The following are the material management practices to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff.

2.6.1 Good Housekeeping

a. An effort will be made to store only enough product required to perform the task. Storage shall meet Federal, State and Local regulations to include 150 % containment of bulk storage over 19 liters.

b. All materials stored onsite will be stored in a neat and orderly manner in their appropriate containers and properly labeled. When possible, material should be stored under a roof or in an enclosed area. If this is not possible, material will be covered with a tarpaulin or suitable replacement to prevent direct contact between storm water and the materials. All runoff from the storage area will be routed through a control structure.

c. Products will be kept in their original containers with the original manufacturer's label.

d. Substances will not be mixed with one another unless recommended by the manufacturer.

e. Whenever possible, all of the product will be used up before disposing of container.

f. Manufacture's recommendations for proper use and disposal will be dictated by Federal, State and Local regulations. Manufacturer's recommendations may be followed if as stringent or more than Federal, State and Local.

g. The contractor will conduct daily inspections to ensure proper use and disposal of materials onsite.

2.6.2 Hazardous Products

These practices are used to reduce the risks associated with hazardous materials and must be incorporated into the Pollution Prevention Plan:

a. Products will be kept in their original containers unless they are not resealable.

b. Original labels and material safety data will be retained they contain important product information.

c. All containers will have the Diamond label affixed per the National Fire Prevention Associations Publication 704.

d. Disposal of surplus product will be performed as recommended by the manufacturer or as required by State and Local regulations.

2.7 SPILL PREVENTION PRACTICES

In addition to good housekeeping and material management practices discussed in the previous sections of this plan, a Site Specific Spill Contingency Plan (SSSCP) must be prepared by the Contractor and submitted to Fort Campbell Environmental Division. The SSSCP must be developed as outlined in the Fort Campbell Environmental Handbook. Guidance and instructions for preparation of the SSSCP are included at the end of this section. In addition to the requirements of the SSSCP, the following practices must be followed by the Contractor for spill prevention and clean up:

a. Materials and equipment necessary for cleanup will be kept in the material storage area. There will be enough equipment to supply at least three (3) men. Equipment and materials will include but not be limited to; brooms, dust pans, mops, rags, gloves, goggles, absorbing compound, and plastic and metal trash containers specifically for this purpose.

b. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of information and cleanup supplies.

c. All spills will be cleaned up immediately after discovery.

d. The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.

e. All spills of toxic or hazardous materials will be reported to the Ft. Campbell Fire Department and DPW Environmental through the Contracting Officers Representative who will report to the appropriate State or Local government agency if necessary.

f. Once a spill has occurred, the spill prevention plan will be adjusted to include measures to prevent this type of spill from recurring with a discussion of the appropriate cleanup for that type of spill. Also, a description of the spill, what cleaned it, and the cleanup measures will be included.

g. The prime Contractor will be responsible for the day-to-day site operations, including spill prevention and will designate an employee, by name, to be the primary cleanup coordinator. Each subcontractor bringing more than 75 liters or 68 kilograms of a spillable substance shall also designate a cleanup coordinator. The cleanup coordinators will designate three (3) additional site personnel for spill prevention and cleanup.

h. Everyone will be trained in spill prevention and cleanup and shall know the primary cleanup coordinator and any additional site personnel to contact. Fort Campbell's Environmental Handbook (excerpt attached) will be the basis for spill prevention training.

(TAKEN FROM)

FORT CAMPBELL ENVIRONMENTAL HANDBOOK
Guidance and Instruction
SPILL PLANNING AND RESPONSE

Spill response equipment is a critical component of an effective response to an unexpected release of hazardous materials. Making an inventory of potential spots for emergency releases and having appropriate and sufficient spill response equipment to deal with those potential releases is required for each unit. Attachment 1 provides spill response materials minimum requirements.

Spill Planning and Response Training Requirements

1) All personnel involved with the management and handling of oil and hazardous materials must be periodically trained in spill prevention and response. The training will be similar to the Hazardous Communication Program - Worker Right to Know and will include the following key features:

a) Health effects of exposure to oil or hazardous materials;

b) Applicable first aid procedures to be used following exposure;

c) Personal Protective Equipment requirements and procedures for using equipment;

d) Evacuation procedures;

e) Spill material combustibility and potential for flash-back along vapor trails;

f) Fire fighting procedures and special hazards of combustible products;

g) Reactivity of spill material with common materials including water;

h) Use and maintenance of all alarms and monitoring equipment associated with spill prevention or response;

I) Initial Notification procedures;

j) Site specific contingency plans;

k) Location of posted Site Specific Spill Contingency Plan;

l) Immediate spill response actions including location of pump controls and valves to stop spill flow; location and use of fire extinguishers, absorbents, neutralizing agents and other immediate spill response procedures;

m) Visual inspections requirements of the particular areas; and

n) Purpose and requirements of good housekeeping.

2) Spill response training exercises will be conducted once per year for personnel working at oil and hazardous material sites. Personnel entering one of these positions will be trained within two weeks after starting work and after any significant changes to the spill plan or training program. Records of the type, extent, and frequency of each individual's training will be maintained until closure of the applicable area or until three years after the date the individual last worked in the area. Refresher training shall be given with the Toolbox Safety Meetings and documented on the Quality Control Reports. Training shall cover what to do, and who to contact in case of a spill and what emergency action must be taken if any.

Spill Response is handled by four distinct operation:

a. REPORT THE SPILL.

The first action in the event of a spill is to report the spill. If you observe a release of a hazardous material, report it to your supervisor and the Fire Department as required below. <u>If the spill is in a Training Area, then the spill will be reported to Range Control</u>, who will then notify the Fire Department. The Fire Department will notify Environmental Division and, if required, Installation Safety, Emergency Medical, and Preventative Medicine. The Environmental Division does all reporting to State/Federal Agencies.

The Fire Department (or Range Control) must be promptly notified of any of the following spills:

Any uncontrolled quantity of a hazardous substance, or if assistance is needed by Fire Department or Environmental Division, or as instructed by the MSDS or supervisor's discretion:

Oil and other petroleum products with quantity exceeding 10 gallons or area of spill greater than two feet in any direction or any amount that is spilled into a stream or body of water.

Environmental Division review has determined the material(s) listed requires special reporting at the quantity shown: (To be supplied by environmental staff during plan review.)

b. STOP OR CONTAIN THE SPILL.

Assess the situation before attempting to contain any hazardous material spilled and proceed only if it is safe to do so. You must have knowledge of the spilled substance and don any required personal protective equipment. If necessary, make the spill scene off limits to any unauthorized personnel. If situation warrants, evacuate the area.

c. CLEAN UP THE SPILL.

Under no circumstances should untrained and/or ill-equipped persons attempt to perform cleanup. In some instances, spill cleanup may require respiratory protection and other personal protective equipment. If it is within the capability of the unit that caused the spill, then that unit is responsible for its cleanup. Environmental Division will make the decision to obtain assistance and coordinate with other units as required. If you handle/work with the hazardous material as part of your job, you are to be trained and qualified to participate in the clean up of the spill.

d. DISPOSE OF SPILLED HAZARDOUS MATERIAL.

2.8 PRODUCT SPECIFIC PRACTICES

The following product specific practices will be followed on-site:

a. Petroleum Products - All vehicles will be periodically inspected for leaks and shall receive regular preventative maintenance to reduce the chance of leaks occurring. Petroleum products will be stored in tightly sealed containers which are clearly labeled. Bulk storage areas will be equipped with secondary containment appropriate for risk of loss from the primary container (s). Storage shall meet Federal, State and Local regulations. Secondary containment shall hold 150 % of the bulk amount stored over 19 liters. The Contractor will maintain a specific spill contingency and countermeasures plan for use in a bulk storage area.

b. Fertilizer - Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to storm water. The contents of any partially used bags of fertilizer will be transferred to a sealable container to avoid spills.

c. Paints, Solvents, and Sealants - All containers will be tightly sealed and kept in the storage area when not in use. Any excesses of these materials will not be discharged into the storm sewer system, but will be properly disposed of according to manufacturer's instructions or State and Local regulations.

d. Concrete Trucks - Concrete trucks will be allowed to wash out, discharge surplus concrete and drum wash water only in a designated area. All wash water from the concrete trucks must be retained on-site and treated according to Federal, State and Local regulations. Upon completion of the job, all discharges of surplus concrete and any soil contaminated by the concrete wash water will be removed from the site and taken to an approved disposal area. Water with the potential of entering sink holes or storm sewers will not be allowed to be discharged.

2.9 INSTALLATION/CONSTRUCTION

2.9.1 Inlet Protection

2.9.1.1 Fabric Drop Inlet Protection

a. Construct a dike on the downslope side of the inlet to prevent runoff from bypassing. Dike should be 150 mm higher than inlet protection.

b. Cut fabric from a single roll to avoid joints.

c. Construct the fence as shown in drawings.

d. Space the support posts evenly against the inlet perimeter a maximum of one (1) m apart, and drive them about 0.5 m into the ground.

2.9.1.2 Gravel Donut Inlet Protection

a. Construct a dike on the downslope side of the inlet to prevent runoff from bypassing. Dike should be 150 mm higher than inlet protection.

b. Construct as shown in drawings.

2.9.1.3 Basket Curb Inlet

a. Install immediately after a new inlet is placed or on existing inlets, before any land disturbing activity.

b. If necessary, adapt basket dimensions to fit inlet box dimensions, see drawings.

c. Remove the grate and place basket in the inlet.

d. Cut and install a piece of filter fabric large enough to line the inside of the basket and extending a minimum of 150 mm beyond the frame.

e. Replace the inlet grate, which also serves to anchor the fabric.

2.9.2 Silt Fence and Silt Fence Rock Overflow

a. Construct as shown on the drawings.

b. Staked and entrenched straw bales must be installed along the base of all fills and cuts and on the downhill sides of stockpiled soil.

2.9.3 Straw Bale Dam

a. Construct as shown on the drawings.

b. Staked and entrenched straw bales must be installed along the base of all fills and cuts and on the downhill sides of the stockpiled soil.

2.9.4 Seeding

a. Test soil to determine its nutrient level or apply a 12-12-12 fertilizer at a rate of 75 to 110 kilograms per hectare.

b. Work fertilizer into the soil 50 mm - 100 mm deep with a disk or rake operated across the slope.

c. Select a seed mixture and application rate that best suits the soil type and climate. Also, consult the county soil, water conservation office for assistance.

d. Apply seed uniformly with a drill or cultipacker seeder, or by broadcasting, and cover to recommended depth.

e. If drilling or broadcasting, firm the seedbed with a roller or cultipacker.

f. Mulch seeded area to increase seeding success.

2.9.5 Mulching

a. Apply at the recommended rate based on the material being used.
b. Spread uniformly with no more than 25% of the ground surface visible.
c. If straw or hay is used, it must be anchored immediately.

2.10 INSPECTION AND MAINTENANCE

All measures that are being utilized will be inspected at least once each week and after each storm event. An inspection report shall be written after each inspection and submitted to the Contracting Office representative within 24 hours. Once a problem is found or sediment has reached the clean-out elevation, corrective action shall commence within 24 hours. Inspections shall continue until the controls are removed or the vegetative cover is firmly established.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall perform all work in such manner as to minimize the pollution of air, water, or land, and shall, within

reasonable limits, control noise and the disposal of solid waste materials, as well as other pollutants. Information contained in the following specifications should also be referenced:

Section 02050 Demolition

3.2 IMPLEMENTATION

Within 10 calendar days after Notice to Proceed and prior to commencement of the work at the site, the Contractor shall meet the representatives of the Contracting Officer to review and alter his proposal as needed for compliance with the environmental pollution control program.

3.3 PROTECTION OF LAND AREAS

Except for any work on storage areas and access routes specifically assigned for the use of the Contractor under this contract, the land areas outside the limits of permanent work performed under this contract shall, in accordance with CONTRACT CLAUSE: PROTECTION OF EXISTING VEGETATION, STRUCTURE, UTILITIES AND IMPROVEMENTS, be preserved in their present condition. Contractor shall confine his construction activities to areas defined for work on the plans or specifically assigned for his use. In accordance with CONTRACT CLAUSE: OPERATIONS AND STORAGE AREAS, storage and related areas and access routes required temporarily by the Contractor in the performance of the work will be assigned by the Contracting Officer. No other areas on Government premises shall be used by the Contractor without written consent of the Contracting Officer.

3.4 PROTECTION OF TREES AND SHRUBS

CONTRACT CLAUSE: PROTECTION OF EXISTING VEGETATION, STRUCTURES, UTILITIES AND IMPROVEMENTS, is hereby supplemented as follows: The Contractor shall not deface, injure or destroy trees or shrubs, nor remove or cut them without special authority. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage.

3.4.1 Tree Protective Structures

Where, in the opinion of the Contracting Officer, trees may possibly be defaced, bruised, injured or otherwise damaged by the Contractor's equipment or by his other operations, he may direct the Contractor to provide temporary protection of such trees by placing boards, plans, or poles around them.

3.4.2 Restoration of Damaged Trees

Any tree scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense. All scars made on trees not designated on the plane to be removed by construction operations shall be coated as soon as possible with an approved tree wound dressing. Trees that are to remain, either within or outside established clearing limits, that are damaged by the Contractor so as to be beyond saving in the opinion of the Contracting Officer, shall be immediately removed, if so directed, and replaced with a nursery-grown tree of the same species and size.

3.5 PROTECTION OF WATER RESOURCES

The Contractor shall control the disposal of fuels, oils, bitumens, calcium chloride, acids, or harmful materials, both on and off the Government premises, and shall comply with applicable Federal, State, County and Municipal laws concerning pollution of rivers and streams while performing work under this contract. The contractor should note that the entire cantonment area is within the Protection Area for Fort Campbell. This means any release in this area has the potential, due to the installations geological features to impact their drinking water source. For this reason special measures need to be taken to prevent chemicals, fuels, oils, greases, bituminous materials, herbicides and insecticides from entering public waters or potentially migrating via sinkholes or other karst related geologic features to drinking water sources. Special measures will include the generation of a site-specific Spill Prevention Control and Countermeasures Plan. Water used in onsite material processing, concrete curing, foundation and concrete cleanup, and other waste waters shall not be allowed to reenter a stream if an increase in the turbidity of the stream could result therefrom.

3.6 BURNING

Air pollution restrictions applicable to this project are as follows. Materials shall not be burned on the Government premises. If the Contractor elects to dispose of waste materials off the Government premises, by burning, he shall make his own arrangements for such burning area and shall, as specified in CONTRACT CLAUSE: PERMITS AND RESPONSIBILITIES, conform to all local regulations.

3.7 DUST CONTROL

The Contractor shall maintain all excavations, stockpiles, access roads, waste areas, and all other work areas free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to the Using Service or to others. Approved temporary methods consisting of sprinkling, chemical treatment, or similar methods will be permitted to control dust. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.

3.8 EROSION CONTROL

Surface drainage from cuts and fills within the construction limits, whether or not completed, and from borrow and waste disposal areas, shall be graded to control erosion within acceptable limits. Temporary control measures shall be provided and maintained until permanent drainage facilities are completed and operative. The area of bare soil exposed at any one time by construction operations should be held to a minimum.

3.9 CORRECTIVE ACTION

The Contractor shall, upon receipt of a notice in writing of any noncompliance with the foregoing provisions, take immediate corrective action. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs of damages by the Contractor unless it was later determined that the Contractor was in compliance.

3.10 POST-CONSTRUCTION CLEANUP OR OBLITERATION

In accordance with CONTRACT CLAUSE: CLEANING UP, the Contractor shall, unless other wise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed areas shall be graded and filled and the entire area seeded.

3.11 PAYMENT

No separate payment or direct payment will be made for the cost of the work covered under this section, and such work will be considered as a subsidiary obligation of the Contractor.

SAFETY PAYS

FT CAMPBELL HAZMAT INVENTORY FORM

SAFETY PAYS

FTCKY HAZMAT INVENTORY FORM
Date: ____/____/____

Ft. Campbell Environmental Division/Pollution Prevention Branch/ 798-3105

Page ____ of ____

Unit (Bde, Bn, Co.): _____ Bldg #: _____ State:_____

POC Name: _____ Phone #: _____

Bldg Description: _____

HazMat Storage Location: _____
(i.e. motor pool, aviation hangar, supply room, etc.)
(i.e. flammable wall locker, supply closet, etc.)

SAFETY PAYS

Example: *6810-00-281-2785*	*CSD Inc.*	*MEK*	*Degreaser*	*12-99*	*Hazardous Waste Disposal*	*1 Can*	*1 Gal.*	*1Gal.*

Updated 3/25/98

SAFETY PAYS

SITE SPECIFIC SPILL CONTINGENCY PLAN

SAFETY PAYS

August 17, 1998

FORT CAMPBELL CONTRACTOR SITE SPECIFIC SPILL CONTINGENCY PLAN

NAME:_____

CONTRACT NUMBER:_____

GENERAL DISCRIPTION OF WORK:_____
_____
_____

_____
_____

A. PRIMARY PERSON
Name: _____
TITLE:_____
Work Phone: _____ Home Phone:
_____

B. ALTERNATE PERSON
Name: _____
TITLE:_____
Work Phone: _____ Home Phone:
_____

C. SECOND ALTERNATE PERSON
Name: _____
TITLE:_____
Work Phone: _____ Home Phone:
_____

If more than one building, Specify hazardous materials for those buildings.
Building (S) #
_____

A. Avoid contacts with spilled substances.

B. Refer to Material Safety Data Sheets (MSDS) for particular hazards and precautionary measures for special handling and spill procedures. Flammable materials will be extinguished as to local fire regulations and the material safety data sheets. If needed, list any materials that need special handling, PPE or special precautionary measures.
_____
_____
_____

items as needed and required)

BUILDING#:_____
BUILDING#:_____
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_____
_____
_____
_____
_____
_____
Material Safety Data Sheets are readily available and located at (the specific location is required).

Bldg.#:_____
Bldg.#:_____

A. REPORT THE SPILL.

The first action in the event of a spill is to report the spill. If you observe a release of a hazardous material, report it to your supervisor and the Fire Department as required below. If the spill is in a Training Area, then the spill will be reported to Range Control, who will then notify the Fire Department. The Fire Department will notify Environmental Division and, if required, Installation Safety, Emergency Medical, and Preventative Medicine. The Environmental Division does all reporting to State/Federal Agencies.

The Fire Department (or Range Control) must be promptly notified of any of the following spills:

Any uncontrolled quantity of a hazardous substance, or if assistance is needed by Fire Department or Environmental Division, or as instructed by the MSDS or supervisor's discretion:

Oil and other petroleum products with quantity exceeding 10 gallons or area of spill greater than two feet in any direction or any amount that is spilled into a stream or body of water.

Environmental Division review has determined the material(s) listed requires special reporting at the quantity shown: (To be supplied by environmental staff during plan review.)

Name: _____ Quantity _____
Name: _____ Quantity _____
Name: _____ Quantity _____

Signature of Environmental Division staff:
_____

SUPERVISOR **(to notify in case of spill**)
NAME: _____ TITLE:_____
WORK PHONE: _____ HOME PHONE: _____:

SAFETY PAYS

phone 911
: phone (502) 798-3001 or on radio frequency FM 49.95
phone (502) 798-3105

1. If required by your , additional people to be notified within your chain of command: If not required, fill in N/A.

ALTERNATE PERSON
NAME: _____ RANK:_____
WORK PHONE: _____ HOME PHONE: _____

ALTERNATE PERSON
NAME: _____ RANK:_____
WORK PHONE: _____ HOME PHONE: _____

The spill report must include the following information:
Name/Phone/Unit of individual reporting the spill;
_____
Spill (Building Location of Number, etc.);
_____
Name of spilled material;
_____
Amount spilled;
_____
Rate currently spilling;
_____
Extent of spill, including drainage features;
_____
Injuries, if any;
_____
Time spill occurred;
_____
Any additional information.
_____

B. STOP OR CONTAIN THE SPILL.

Assess the situation before attempting to contain any hazardous material spilled and proceed only if it is safe to do so. You must have knowledge of the spilled substance and don any required personal protective equipment. If necessary, make the spill scene off limits to any unauthorized personnel. If situation warrants, evacuate the area.

C. CLEAN UP THE SPILL.

Under no circumstances should untrained and/or ill-equipped persons attempt to perform cleanup. In some instances, spill cleanup may require respiratory protection and other personal protective equipment. If it is within the capability of the unit that caused the spill, then that unit is responsible for its cleanup. Environmental Division will make the decision to obtain assistance and coordinate with other units as required. If you handle/work with the hazardous material as part of your job, you are to be trained and qualified to participate in the clean up of the spill.

D. DISPOSE OF SPILLED HAZARDOUS MATERIAL.

Responsible Person Signature and Date
_____

SAFETY PAYS

CONTRACTOR'S SIGNATURE FORM

SAFETY PAYS

Construction Activity Water Permitting Requirements

Contractor's Signature Form

State of Tennessee
Department of Environment and Conservation

Rule 1200-4-10.05
Division of Water Pollution Control

NPDS General Permit TNR 100000

To be completed by developer:
NOI Submission Date:_____

Project
Name:_____
_____

Project
Location:_____
__County

I have agreed to perform construction-related professional services, described as:

_____
that will likely impact the nature of storm water runoff from the named construction activity. Erosion control services involve primarily:

____ Prepare erosion control plan ____
Inspection of controls
____ Install, maintain erosion and sediment controls ____ Other

I understand the terms and conditions of Rule 1200-4-10-.05 and that I, and my company, as the case may be, are responsible for the legally liable for complying with this Rule and the applicable State and Federal Laws. I understand that State or EPA or private actions may be taken against me if the terms and conditions of the Rule are not met.

Printed Name:_____
Title:_____

Signature:_____
Date:_____

Company
Name:_____
_____

Address:_____
_____

City:_____ State:_____ Phone

SAFETY PAYS

No._____

Field Person in charge:_____ Phone No._____

Owner/Developer: I certify that the above has been retained to perform the described construction

related services noted above and as outlined in the referenced NOI.

Signature: _____
Date:_____

-- End of Section --

SECTION 01451

CONTRACTOR QUALITY CONTROL
08/97

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*** SAFETY PAYS ***

SECTION 01451

CONTRACTOR QUALITY CONTROL
08/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(1996) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(1995b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

1.3 SUBMITTALS

Contractor Quality Control Plan; "GA"

Quality Control Documentation; "FIO"

Daily CQC Reports; "FIO"

Deficiency Tracking System; "FIO"

Test Results; "FIO"

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause entitled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with quality requirements specified in the contract. The project superintendent in this context shall mean the individual with the responsibility for the overall management of the project including quality and production.

3.2 QUALITY CONTROL PLAN

3.2.1 General

The Contractor shall furnish for review by the Government, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause entitled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.2.2 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters will also be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section C-01330 SUBMITTAL PROCEDURES.

e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and has separate control requirements. It could be identified by different trades or disciplines, or it could be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 30 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.3.1 Subcontractor CQC Orientation

Before a Subcontractor begins work on the jobsite, the CQC System Manager will train the Subcontractor by showing the video tape entitled "CQC" -- A Bridge (or Pathway) to Success" and answering any questions pertaining to quality control operations. This requirement is waived only if a Subcontractor attended the initial coordination meeting described above. A copy of this video can be borrowed from the Contracting Officer. A record of the orientation shall be documented in the QC Report.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 General

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure contract compliance. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Contracting Officer.

3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within his organization at the site of the work who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a Graduate Engineer, Architect or a graduate of construction management and have a minimum of 10 years construction experience on construction similar to this contract. This CQC System Manager shall be on the site at all times during construction and will be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties. An alternate for the CQC System Manager will be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate will be the same as for the designated CQC System Manager.

3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: electrical, mechanical, civil, structural, environmental/safety manager, kitchen equipment specialists and architectural. These individuals shall be employed by the prime Contractor or the subcontractor resposible for the specific work ares of resposibility; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals shall have no other duties other than quality control.

Experience Matrix

Area	Qualifications
a. Civil	Graduate Civil Engineer with 2 years experience in the type of work being performed on this project or technician with 5 yrs related experience.
b. Mechanical	Graduate Mechanical Engineer with 2 yrs experience or person with 5 yrs related experience.

c. Electrical	Graduate Electrical Engineer with 2 yrs related experience or person with 5 yrs related experience.
d. Structural	Graduate Structural Engineer with 2 yrs experience or person with 5 yrs related experience.
e. Kitchen Equipment Specialist	Kitchen supplier/installer person with minimum 5 yrs related experience with commercial kitchens of equal or larger serving capacity.
f. Architectural	Graduate Architect with 2 yrs experience or person with 5 yrs related experience.
g. Environmental / Safety Manager	Graduate Environmental Engineer with 3 yrs experience or person with 5 years related experience. Experience shall include HTRW work, (i.e. Lead, Asbestos, Hazardous Material, Hazardous Waste) NPDES and NOI requirements.

NOTE: Related experience is defined as the individual in a quality control position for the related field for the minimum number of years specified.

3.4.4 Additional Requirement

In addition to the above experience and education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management For Contractors". This course is periodically offered by the Associated Builders and Contractors, Inc., or Associated General Contractors, Inc.

3.4.5 Organizational Changes

The Contractor shall maintain his CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS

Submittals shall be made as specified in Section 01300 SUBMITTAL PROCEDURES. The CQC organization

shall be responsible for certifying that all submittals are in compliance with the contract requirements.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

a. A review of each paragraph of applicable specifications.

b. A review of the contract drawings.

c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.

e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

g. A review of the appropriate activity hazard analysis to assure safety requirements are met.

h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

j. Resolve all differences.

k. Discussion of the initial control phase.

l. The Government shall be notified at least 24 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon or conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if the quality of on-going work is unacceptable, if there are changes in the onsite production supervision or work crew, if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

e. Results of all tests taken, both passing and failing tests, will be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test will be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility will be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing Laboratories

3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of $1375.00 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.7.3 On-Site Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials shall be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the U.S. Army Engineer Waterways Experiment Station, f.o.b., at the following address:

Commander and Director
U.S. Army Engineer Waterways Experiment Station
ATTN: CEWES-GS
3909 Halls Ferry Road

Vicksburg, MS 39180-6199

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Near the completion of all work or any increment thereof established by a completion time stated in the Special Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the CQC System Manager shall conduct an inspection of the work and develop a punch list of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

At the completion of all work or any increment thereof established by a completion time stated in the Special Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the CQC System Manager shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. Once this is accomplished the Contractor shall notify the Government that the facility is complete and is ready for the Government's "Prefinal" inspection. The Government will perform this inspection to verify that the facility is complete and ready to be occupied. A Government "Prefinal Punch List" will be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected and so notify the Government so that a "Final" inspection with the customer can be scheduled. Any items noted on the "Final" inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph will be accomplished within the time slated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, his superintendent or other primary management person and the contracting Officer's representative will be in attendance at this inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon notice from the Contractor. This notice will be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and must include the Contractor's assurance that all specific items previously identified to the Contractor as being acceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause entitled "Inspection of Construction".

3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

a. Contractor/subcontractor and their area of responsibility.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.

e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

f. Submittals reviewed, with contract reference, by whom, and action taken.

g. Off-site surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date(s) covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every seven days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

k. Deficiency Tracking System. The Contractor shall maintain a cumulative list of deficiencies identified for the duration of the project. Deficiencies to be listed include those failures, Government oral observations and Notifications of Noncompliance. The list shall be maintained at the project site. Copies of updated listings shall be submitted to the Government at least every 30 days.

3.10 SAMPLE FORMS

***** SAFETY PAYS *****

Sample forms for Daily Construction Quality Control Report and Deficiency List are enclosed at the end of Section 00800 as well as other forms the Contractor may utilize during this project.

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the worksite, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

--END OF SECTION--

*** SAFETY PAYS ***

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

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1.2 AVAILABILITY AND USE OF UTILITY SERVICES....01500-2
1.3 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN....01500-3
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*** SAFETY PAYS ***

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

1.1 GENERAL REQUIREMENTS

1.1.1 Site Plan

The Contractor shall prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Any areas which may have to be graveled to prevent the tracking of mud shall also be identified. The Contractor shall also indicate if the use of a supplemental or other staging area is desired.

1.1.2 Identification of Employees

The Contractor shall be responsible for furnishing to each employee, and for requiring each employee engaged on the work to display, identification as approved and directed by the Contracting Officer. Prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of any employee. When required, the Contractor shall obtain and provide fingerprints of persons employed on the project. Contractor and subcontractor personnel shall wear identifying markings on hard hats clearly identifying the company for whom the employee works.

1.1.3 Employee Parking

Contractor employees shall park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking shall not interfere with existing and established parking requirements of the military installation.

1.2 AVAILABILITY AND USE OF UTILITY SERVICES

1.2.1 Payment for Utility Services

The Government will make all reasonably required utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

1.2.2 Meters and Temporary Connections

The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain necessary temporary connections, distribution lines, and meter bases required to measure the amount of each utility used for the purpose of determining charges. The Contractor shall notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established. The Government will provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. The Contractor shall not make the final electrical connection.

1.2.3 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of $50.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed to the Contractor prior to the end of the current fiscal year.

1.2.4 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, the Contractor shall notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meters. The Contractor shall then remove all the temporary distribution lines, meter bases, and associated paraphernalia. The Contractor shall pay all outstanding utility bills before final acceptance of the work by the Government.

1.2.5 Sanitation

The Contractor shall provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

1.2.6 Telephone

The Contractor shall make arrangements and pay all costs for telephone facilities desired.

1.3 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

1.3.1 Bulletin Board

Immediately upon beginning of work, the Contractor shall provide a weatherproof glass-covered bulletin board not less than 915 by 1220 mm in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. The bulletin board shall be located at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of work the bulletin board shall be removed by and remain the property of the Contractor.

1.3.2 Project and Safety Signs

The requirements for the signs, their content, and location shall be as shown on the drawings. The signs shall be erected within 15 days after receipt of the notice to proceed. The data required by the safety sign shall be corrected daily, with light colored metallic or non-metallic numerals. Upon completion of the project, the signs shall be removed from the site.

1.4 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction the Contractor shall provide access and temporary relocated roads as necessary to maintain traffic. The Contractor shall maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. The traveling public shall be protected from damage to person and property. The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. The Contractor shall investigate the adequacy of existing roads and the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

1.4.1 Haul Roads

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Haul roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided. The Contractor shall provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of

construction and hauling roads shall be subject to approval by the Contracting Officer. Lighting shall be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations. Upon completion of the work, haul roads designated by the Contracting Officer shall be removed.

1.4.2 Barricades

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall be securely placed, clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

1.5 CONTRACTOR'S TEMPORARY FACILITIES

1.5.1 Administrative Field Offices

The Contractor shall provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

1.5.2 Storage Area

The Contractor shall construct a temporary 1.8 m high chain link fence around trailers and materials. The fence shall include plastic strip inserts, colored brown, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the military boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day. Materials shall not be stockpiled outside the fence in preparation for the next day's work. Mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, shall be parked within the fenced area at the end of each work day.

1.5.3 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but shall be within the military boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

1.5.4 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on the military property.

1.5.5 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

1.5.6 New Building

In the event a new building is constructed for the temporary project field office, it shall be a minimum 3.6 m in width, 5 m in length and have a minimum of 2.1 m headroom. It shall be equipped with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. It shall be provided with a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building shall be waterproof, shall be supplied with heater, shall have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Approved sanitary facilities shall be furnished. The windows and doors shall be screened and the doors provided with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins shall be non-removable. The windows shall be arranged to open and to be securely fastened from the inside. Glass panels in windows shall be protected by bars or heavy mesh screens to prevent easy access to the building through these panels. In warm weather, air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 11 degrees C below the outside temperature when the outside temperature is 35 degrees C, shall be furnished. Any new building erected for a temporary field office shall be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work shall become the property of the Contractor and shall be removed from the site. All charges for telephone service for the temporary field office shall be borne by the Contractor, including long distance charges up to a maximum of $75.00 per month.

1.5.7 Security Provisions

Adequate outside security lighting shall be provided at the Contractor's temporary facilities. The Contractor shall be responsible for the security of its own equipment; in addition, the Contractor shall notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

1.6 GOVERNMENT FIELD OFFICE FACILITIES AND SERVICES

1.6.1 General.

The contractor shall furnish a field office (within 30 days of Notice to Proceed) with a minimum of 1200 square feet free office space for the exclusive use of the Government Inspectors. It shall be weathertight, lockable, with open/close windows, properly heated, with electrical hookup, adequately lighted, with wall receptacles, ventilated, air conditioned, and furnished with seven lockable desks (30”x60”) with swivel chairs, 12 filing cabinets (with 4 drawers each), a desktop copy machine with maintenance, seven (30”x60”) tables, a plan table with stool, 12 straight back chairs, a small refrigerator, a desktop fax machine with maintenance, seven telephones connected to the post telephone system (including 4 voice lines - The contractor is responsible for making connection arrangements with the post), and two restrooms with toilets and wash basins. The toilets and wash basins shall be hooked up by the contractor to water and sewer lines. The office will be partitioned to have four individual offices with three at 120 square feet each and one at 180 square foot. A conference room of 200 square feet shall be provided. The contractor shall also furnish bottled drinking water with dispenser and disposable drinking cups. The office layout shall be coordinated with government representatives. The facilities will be for the contract duration including the contractor demobilization period. A minimum of eight spaces will be available for government vehicle parking (Parking and access from the closest pavement shall be 6” graded Kentucky 610’s. The road and pavement shall be maintained by addition of gravel and grading as required). A six foot chain link security fence with double vehicular (20 foot wide) gates shall be installed around the office.

1.6.1.1 Utility Services. The Contractor shall arrange for and pay all costs for water, electricity, propane gas or other utilities as necessary for the field office for the life of the contract. The existing equipment shall be cleaned and then serviced a minimum of biweekly.

1.6.1.2 Janitor Service. The contractor shall furnish daily janitorial services for the Government office and perform normal maintenance as deemed necessary by the Contracting Officer for the life of the contract. The supply of all cleaning equipment and materials shall be the responsibility of the contractor. Toilet facilities shall be kept clean and sanitary at all times. Toilet paper, hand soap, paper towels and other materials the Contracting Officer deems necessary to provide sanitary facilities shall be furnished by the contractor. Services

shall be performed at such time and in such a manner to least interfere with the operations, but will be accomplished during normal working hours. Services shall be accomplished to the satisfaction of the Contracting Officer. The contractor shall also provide daily trash collection and clean-up of the Government buildings and adjacent outside areas, and mowing of grass at least weekly in season, and shall dispose of all discarded debris, aggregate samples and concrete test samples, all in a manner approved by the Contracting Officer.

1.6.2 Computers. The Contractor shall furnish computer equipment, wiring, connections and telephone service and maintenance services during the project for the exclusive use of the Government The equipment and services shall be provided and fully functional within 45 calendar days from Notice to Proceed. The computer system shall be connected to provide an inter-office network as well as internet access. Proposed equipment/system shall be approved by the Government prior to installation.

1.6.2.1 Equipment Description. The contractor shall furnish the computer equipment as follows:

a. Workstations Required: 6 each

Workstation Equipment: Shall be capable of running Microsoft Windows 95 and Microsoft Office 97 and shall be provided on each workstation. The workstations, as a minimum, shall consist of PC's similar or equal to Dell Optiplex GX1 equipped with the equivalent of a 350 MHz Pentium II processor with MMX, 64 MB memory, 4GB hard drive, 17" SVGA monitor, 4MB video card, 12x CD ROM, network capable, 1.44 floppy disk drive, removable high capacity drive or tape back-up.

b. Inter-office Network System: 1 each

Network System: Shall be a Windows NT server system using NT 4.0 as a minimum. System shall be set up to connect to all workstations and printer.

Server: Similar or equal to Dell Poweredge 2200 Server to include a minimum of 64 MB ROM and 6 GB of hard drive and tape back-up.

Printer: Networked laser printer similar or equal to a Hewlett Packard Laser Jet 5 SE with a minimum of 10 MB RAM. Maintenance, repairs and toner supplies are to be provided for the specified duration above.

1.6.2.2 Installation and Internet Connection. Within the time frame stipulated, the contractor shall install the computer equipment, including all miscellaneous wiring, connectors, etc. and provide a fully functioning computer system. The Contractor shall procure with local internet service providers unlimited internet access to each separate computer workstation. The contractor will enter into and maintain the local internet service agreement for the period of use stated. The contractor shall provide all telephone cabling and connections from the existing commercial telephone company. Use of Government telephone lines, connections and numbers is not permitted. The internet service may be provided to each workstation via a 56.6 k individual modem and phone line or through the office network system.

1.6.2.3 Maintenance Service. Hardware maintenance, repair and replacement will be contractor responsibility for the service period required. Next business day service is required for equipment problems unless waived by the Government in each instance.

1.6.2.4 Software. Office network system shall have Microsoft Windows 95 and MS Office 97 (Word and Excel) software running on each workstation. Backup, virus protection, internet and E-mail software will be installed on the system.

1.6.2.5 Payment. The Contractor shall provide the computer equipment and services as stipulated herein in this paragraph. No separate payment will be made for this contractor furnished and installed computer equipment and services and all costs thereof shall be incidental to the various bid items of the contract.

1.7 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor shall install a satisfactory means of communication, such as telephone or other suitable devices. The devices shall be made available for use by Government personnel.

1.8 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, the Contractor shall furnish and erect temporary project safety fencing at the work site. The safety fencing shall be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 1.1 m high, supported and tightly secured to steel posts located on maximum 3 m centers, constructed at the approved location. The safety fencing shall be maintained by the Contractor during the life of the contract and, upon completion and acceptance of the work, shall become the property of the Contractor and shall be removed from the work site.

1.9 CLEANUP

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away. Materials resulting from demolition activities which are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

1.10 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

SECTION 01565

STORMWATER POLLUTION PREVENTION MEASURES
08/96

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1.1 REFERENCES 01565-1
1.2 GENERAL 01565-1
1.3 SUBMITTALS 01565-1
1.4 EROSION AND SEDIMENT CONTROLS 01565-1
PART 2 PRODUCTS 01565-3
2.1 COMPONENTS FOR SILT FENCES 01565-3
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***** SAFETY PAYS *****

SECTION 01565

STORMWATER POLLUTION PREVENTION MEASURES
08/96

PART 1 GENERAL

1.1 REFERENCES
The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3786 (1987) Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method

ASTM D 4439 (1995) Standard Terminology for Geotextiles

ASTM D 4491 (1992) Water Permeability of Geotextiles by Permittivity

ASTM D 4533 (1991) Trapezoid Tearing Strength of Geotextiles

ASTM D 4632 (1991) Grab Breaking Load and Elongation of Geotextiles

ASTM D 4751 (1995) Determining Apparent Opening Size of a Geotextile

ASTM D 4873 (1995) Identification, Storage, and Handling of Geotextiles

1.2 GENERAL

The Contractor shall implement the storm water pollution prevention measures specified in this section in a manner which will meet the requirements of Section 01410 ENVIRONMENTAL PROTECTION, and the requirements of the National Pollution Discharge Elimination System (NPDES) permit attached to that Section.

1.3 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Mill Certificate or Affidavit; FIO.

1.4 EROSION AND SEDIMENT CONTROLS

The controls and measures required by the Contractor are described below.

1.4.1 Stabilization Practices

The stabilization practices to be implemented shall include temporary seeding, mulching, geotextiles, protection of trees, preservation of mature vegetation, etc. On his daily CQC Report, the Contractor shall record the dates when the major grading activities occur, (e.g., clearing and grubbing, excavation,

embankment, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS, stabilization practices shall be initiated as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have temporarily or permanently ceased.

1.4.1.1 Unsuitable Conditions

Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases is precluded by unsuitable conditions caused by the weather, stabilization practices shall be initiated as soon as practicable after conditions become suitable.

1.4.1.2 No Activity for Less Than 21 Days

Where construction activity will resume on a portion of the site within 21 days from when activities ceased (e.g., the total time period that construction activity is temporarily ceased is less than 21 days), then stabilization practices do not have to be initiated on that portion of the site by the fourteenth day after construction activity temporarily ceased.

1.4.2 Structural Practices

Structural practices shall be implemented to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Structural practices shall be implemented in a timely manner during the construction process to minimize erosion and sediment runoff. Structural practices shall include the following devices. Location and details of installation and construction are shown on the drawings.

a. Silt fences.
b. Straw bales.
e. Check dams.
i. Storm drain inlet protection.
j. Rock outlet protection.
k. Sediment traps.
n. Sediment basins.

1.4.2.1 Silt Fences

The Contractor shall provide silt fences as a temporary structural practice to minimize erosion and sediment runoff. Silt fences shall be properly installed to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading). Silt fences shall be installed in the locations indicated on the drawings. Final removal of silt fence barriers shall be upon approval by the Contracting Officer.

1.4.2.2 Straw Bales

The Contractor shall provide bales of straw as a temporary structural practice to minimize erosion and sediment runoff. Bales shall be properly placed to effectively retain sediment immediately after completing each phase of work (e.g., clearing and grubbing, excavation, embankment, and grading) in each independent runoff area (e.g., after clearing and grubbing in a area between a ridge and drain, bales shall be placed as work progresses, bales shall be removed/replaced/relocated as needed for work to progress in the drainage area). Areas where straw bales are to be used are shown on the drawings. Final removal of straw bale barriers shall be upon approval by the Contracting Officer. Rows of bales of straw shall be provided as follows:

a. Along the downhill perimeter edge of all areas disturbed.

b. Along the top of the slope or top bank of drainage ditches, channels, swales, etc. that traverse disturbed areas.

c. Along the toe of all cut slopes and fill slopes of the construction areas.

d. Perpendicular to the flow in the bottom of existing drainage ditches, channels, swales, etc. that traverse disturbed areas or carry runoff from disturbed areas.

e. Perpendicular to the flow in the bottom of new drainage ditches, channels, and swales.

f. At the entrance to culverts that receive runoff from disturbed areas.

PART 2 PRODUCTS

2.1 COMPONENTS FOR SILT FENCES

2.1.1 Filter Fabric

The geotextile shall comply with the requirements of ASTM D 4439, and shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistance to deterioration due to ultraviolet and heat exposure. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of -18 to 49 degrees C. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE

PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile	ASTM D 4632	445 N min.
Elongation (%)		30 % max.
Trapezoid Tear	ASTM D 4533	245 N min.
Mullen Burst	ASTM D 3786	1200 N min.
Permittivity	ASTM D 4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D 4751	20-100

2.1.2 Silt Fence Stakes and Posts

The Contractor may use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 50 mm by 50 mm when oak is used and 100 mm by 100 mm when pine is used, and shall have a minimum length of 1.5 m. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum mass of 1.98 kg per linear meter and a minimum length of 1.5 m.

2.1.3 Mill Certificate or Affidavit

A mill certificate or affidavit shall be provided attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. The mill certificate or affidavit shall specify the actual Minimum Average Roll Values and shall identify the fabric supplied by roll identification numbers. The Contractor shall submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

2.1.4 Identification Storage and Handling

Filter fabric shall be identified, stored and handled in accordance with ASTM D 4873.

2.2 COMPONENTS FOR STRAW BALES

The straw in the bales shall be stalks from oats, wheat, rye, barley, or rice, furnished in air dry condition. The bales shall have a standard cross section of 350 mm by 450 mm. All bales shall be either wire-bound or string-tied. The Contractor may use either wooden stakes or steel posts to secure the straw bales to the ground. Wooden stakes utilized for this purpose, shall have a minimum dimensions of 50 mm by 50 mm in cross section and shall have a minimum length of 1 m. Steel posts (standard "U" or "T" section) utilized for securing straw bales, shall have a minimum mass of 1.98 kg per linear meter and a minimum length of 1 m .

PART 3 EXECUTION

3.1 INSTALLATION OF SILT FENCES

Silt fences shall extend a minimum of 400 mm above the ground surface and shall not exceed 860 mm above the ground surface. Filter fabric shall be from in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be spliced together at a support post, with a minimum 150 mm overlap, and securely sealed. A trench shall be excavated approximately 100 mm wide and 100 mm deep on the upslope side of the location of the silt fence. The 100 mm by 100 mm trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed upon approval by the Contracting Officer.

3.2 INSTALLATION OF STRAW BALES

Straw bales shall be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 100 mm. After the bales are staked and chinked (gaps filled by wedging with straw), the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 100 mm against the uphill side of the barrier. Loose straw shall be scattered over the area immediately uphill from a straw bale barrier to increase barrier efficiency. Each bale shall be securely anchored by at least two stakes driven through the bale. The first stake or steel post in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or steel pickets shall be driven a minimum 450 mm deep into the ground to securely anchor the bales.

3.3 MAINTENANCE

The Contractor shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by

repair of erosion and sediment control measures and other protective measures. The following procedures shall be followed to maintain the protective measures.

3.3.1 Silt Fence Maintenance

Silt fences shall be inspected in accordance with paragraph INSPECTIONS. Any required repairs shall be made promptly. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. When a silt fence is no longer required, it shall be removed. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with Section 02935 TURF, except that the coverage requirements in paragraph ESTABLISHMENT do not apply.

3.3.2 Straw Bale Maintenance

Straw bale barriers shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales. Necessary repairs to barriers or replacement of bales shall be accomplished promptly. Sediment deposits shall be removed when deposits reach one-half of the height of the barrier. Bale rows used to retain sediment shall be turned uphill at each end of each row. When a straw bale barrier is no longer required, it shall be removed. The immediate area occupied by the bales and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with Section 02935 TURF.

3.4 INSPECTIONS

3.4.1 General

The Contractor shall inspect disturbed areas of the construction site, areas used for storage of materials that are exposed to precipitation that have not been finally stabilized, stabilization practices, structural practices, other controls, and area where vehicles exit the site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 13 mm or more rainfall at the site. Where sites have been finally stabilized, such inspection shall be conducted at least once every month.

3.4.2 Inspections Details

Disturbed areas and areas used for material storage that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan shall be observed to ensure that they are operating correctly. Discharge locations or points shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles exit the site shall be inspected for evidence of offsite sediment tracking.

3.4.3 Inspection Reports

For each inspection conducted, the Contractor shall prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. The report shall be furnished to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.

***** SAFETY PAYS *****

--End of Section--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION DISCOM Barracks Complex Phase I/IIA, Fort Campbell, KY				CONTRACTOR										SPEC. SECTION 01565
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-13 Certificates										
		1	Mill Certificate or Affidavit; FIO.										

SECTION 01800

EQUIPMENT OPERATING, MAINTENANCE, AND REPAIR MANUALS
11/93

PART 1 GENERAL 01800-1
1.1 SUMMARY (Not Applicable) 01800-1
1.3 DEFINITIONS 01800-1

PART 2 PRODUCTS (NOT USED) 01800-2
3.1 GENERAL 01800-2
3.2 SYSTEM/EQUIPMENT REQUIREMENTS 01800-4

SAFETY PAYS

SECTION 01800

EQUIPMENT OPERATING, MAINTENANCE, AND REPAIR MANUALS
11/93

PART 1 GENERAL

1.1 SUMMARY (Not Applicable)

1.2 General Requirements

The Contractor shall provide 6 complete copies of the Equipment Operating, Maintenance, and Repair Manuals. Separate manuals shall be provided for each utility system as defined hereinafter. Operations and Maintenance manuals shall be submitted and approved before field training or 90 days before substantial completion (whichever occurs earlier), and as specified in Special Contract Requirement 10. An amount of .5% of Contract Amount shall be withheld until submittal and approval of O&M manuals is complete.

1.3 DEFINITIONS

1.3.1 Equipment

A single piece of equipment operating alone or in conjunction with other equipment to accomplish a system function.

1.3.2 System

A combination of one or more pieces of equipment which function together to accomplish an intended purpose (i.e. HVAC system is composed of many individual pieces of equipment such as fans, motors, compressors, valves, sensors, relays, etc.)

1.3.3 Hard Cover Binders

The manuals shall be hard cover with posts, or 3-ring binders, so sheets may be substituted easily. The following identification shall be printed on the cover: the words "EQUIPMENT OPERATING, MAINTENANCE, AND REPAIR MANUALS," the project name, building number, and an indication of utility or systems covered, the name of the Contractor, and the Contract number. Manuals shall be approximately 8-1/2 by 11-inches with large sheets folded in and capable of being easily pulled out for reference. All manuals for the project must be similar in appearance, and be of professional quality.

1.3.4 Warning Page

A warning page shall be provided to warn of potential dangers (if they exist, such as high voltage, toxic chemicals, flammable liquids, explosive materials, carcinogens, high pressures, etc.). The warning page shall be placed inside the front cover and in front of the title page. Also, any necessary Material Safety Data Sheets (MDSD) shall be included here.

1.3.5 Title Page

The title page shall include the same information shown on the cover and show the name of the preparing firm and the date of publication.

1.3.6 Table of Contents

Each volume of the set of manuals for this project shall include a table of contents, for the entire set, broken down by volume.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 GENERAL

Manuals shall be organized according to the following format, and will include information for each item of equipment (NOTE: This includes any equipment which may have been omitted from the items listed in Paragraph 3.2, System/Equipment Requirements.) A draft outline and table of contents shall be submitted for approval at 50% contract completion.

TABLE OF CONTENTS

PART I. Introduction.

(a) Equipment Description.
(b) Functional Description.
(c) Installation Description.

PART II. Operating Principles.

PART III. Safety.

PART IV. Preventive Maintenance

(a) Preventive Maintenance Checklist. Lubrication
(b) Charts and Diagrams.

PART V. Spare Parts Lists

(a) Troubleshooting Guide
(b) Adjustments
(c) Common Repairs and Parts Replacement

PART VI. Illustrations

3.1.1 Part I-Introduction

Part I shall provide an introduction, equipment or system description, functional description and theory of operation, and installation instructions for each piece of equipment. Complete instructions for uncrating, assembly, connection to the power source and pre-operating lubrication shall be included in the installation instructions as applicable. Illustrations, including wiring and cabling diagrams, are required as appropriate in this section. Halftone pictures of the equipment should be included in the introduction and equipment description, as well as system layout drawings with each item of equipment located and marked. Copies of previously submitted shop drawings shall not be used in these manuals.

3.1.2 Part II-Operating Principles

Part II shall provide complete instructions for operating the system, and each piece of equipment. Illustrations, halftone pictures, tables, charts, procedures, and diagrams are required when applicable. This will include step-by-step procedures for start-up and shutdown of both the system and each component piece of equipments, as well as adjustments required to obtain optimum equipment performance, and corrective actions for malfunctions. Performance sheets and graphs showing capacity data, efficiencies, electrical characteristics, pressure drops, and flow rates shall be shown here, also. Marked-up catalogs or catalog pages do not satisfy this requirements. Performance information shall be presented as concisely as possible and contain only data pertaining to equipment actually installed. Actual test data collected for Contractor performance shall be included here.

3.1.3 Part III-Safety

Part III shall contain the general and specific safety requirements peculiar to each item of equipment. Safety information should be repeated as notes cautions, and warnings in other sections where appropriate to operations described.

3.1.4 Part IV-Preventive Maintenance

Part IV shall contain a troubleshooting guide, including detailed instructions for all common adjustments and alignment procedures, including a detailed maintenance schedule. Also, include a diagnostic chart showing symptoms and solutions to problems. Include test hookups to determine the cause, special tools and test equipment, and methods for returning the equipment to operating conditions. Information may be in chart form or in tabular format with appropriate headings. Instructions shall be included for the removal, disassembly, repair, reassembly, and replacement of parts and assemblies where applicable and the task is not obvious.

3.1.5 Part V-Spare Parts List

Part V shall contain a tabulation of description data and parts location illustrations for all mechanical and electrical parts. The heading of the parts list shall clearly identify the supplier, purchase order number, and equipment. The unit price for each part shall be included, also. Parts shall be listed by major assemblies, and the listing shall be arranged in columnar form. Also, names and addresses of the nearest manufacturer's representatives will be included, as well as any special warranty information. A list of spare parts that are recommended to be kept in stock by the Government installation shall be provided.

3.1.6 Part VI-Illustrations

Part VI shall contain assembly drawings for the complete equipment or system and for all major components. Complete wiring diagrams and schematics shall be included. Other illustrations, such as exploded views, block diagrams, and cutaway drawings, are required as appropriate.

3.1.7 Framed Instructions

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, including equipment, ductwork, piping valves, dampers, and control sequence, shall be posted at a location near the equipment described. Condensed operating instructions explaining preventive maintenance procedures methods of checking the system for normal safe operation, valve schedule and procedures for safely starting and stopping the system shall be prepared in type form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. Proposed diagrams, instructions, and other sheets shall be submitted prior to posting. The framed instructions shall be posted before field training.

3.1.8 Field Training

Contractor shall conduct a training course for the operating staff for each particular system. The training period shall start after the system is functionally completed. The field instructions shall cover all of the items contained in the Equipment Operating, Maintenance and Repair Manuals. The training will include both classroom and "hands-on" training. The Contractor shall submit a lesson plan outlining the information to be discussed during training periods. This lesson plan will be submitted 90 days before contract completion and approved before the field training occurs. Training shall be documented by the Contractor and a list of attendees shall be furnished to the Government.

3.2 SYSTEM/EQUIPMENT REQUIREMENTS

3.2.1 Facility Heating System

Information shall be provided on the following equipment: boilers, water treatment, chemical feed pumps and tanks, converters, heat exchangers, pumps, unit heaters, fin-tube radiation, air handling units (both heating only and heating and cooling), and valves (associated with heating systems).

3.2.2 Air-Conditioning Systems

Provide information in chillers, packaged air-conditioning equipment, towers, water treatment, chemical feed pumps and tanks, air-cooled condensers, pumps, compressors, air handling units, and valves (associated with air-conditioning systems).

3.2.3 Temperature Control and HVAC Distribution Systems

Provide all information described for the following equipment: valves, fans, air handling units, pumps, boilers, converters and heat exchangers, chillers, water cooled condensers, cooling towers, and fin-tube radiation, control air compressors, control components (sensors, controllers, adapters and actuators), and flow measuring equipment.

3.2.4 Exterior Electrical Systems

Information shall be provided on the following equipment: power transformers, relays, reclosers, breakers, and capacitor bank controls.

3.2.5 Interior Electrical Systems

Information shall be provided on the following equipment: relays, motor control centers, switchgear, solid state circuit breakers, motor controller, EPS lighting systems, wiring diagrams and troubleshooting flow chart on control systems, and special grounding systems.

3.2.6 Energy Monitoring and Control Systems

The maintenance manual shall include descriptions of maintenance for all equipment, including inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components.

3.2.7 Domestic Water Systems

The identified information shall be provided on the following equipment: tanks, unit process equipment, pumps, motors, control and monitoring instrumentation, laboratory test equipment, chemical feeders, valves, switching gear, and automatic controls.

3.2.8 Fire Protection Systems

Information shall be provided on the following equipment: alarm valves, manual valves, regulators, foam and gas storage tanks, piping materials, sprinkler heads, nozzles, pumps, and pump drivers.

3.2.9 Fire Detection Systems

The maintenance manual shall include description of maintenance for all equipment, including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

3.2.10 Plumbing Systems

Information shall be provided on the following equipment: water heaters, valves, pressure regulators backflow preventors, piping materials, and plumbing fixtures.

3.2.11 Cathodic Protection Systems

Information shall be provided on the following material and equipment: rectifiers, meters, anodes, anode backfill, anode lead wire, insulation material and wire size, automatic controls (if any), rheostats, switches, fuses and circuit breakers, type and size of rectifying elements, type of oil in oil-immersed rectifiers, and rating of shunts.

3.2.12 Miscellaneous Systems

Information shall be provided on the following: communication and ADP systems, security and intrusion alarm, sound and material delivery systems, kitchen, refrigeration, disposal, icemaking equipment, and other similar type special systems not otherwise specified.

--END OF SECTION--

SECTION 02050

DEMOLITION
10/97

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1.2 GENERAL REQUIREMENTS 02050-1
1.3 SUBMITTALS 02050-1
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***** SAFETY PAYS *****

SECTION 02050

DEMOLITION
10/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ENGINEERING MANUALS (EM)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.2 GENERAL REQUIREMENTS

The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and other debris shall be removed from government property daily, unless otherwise directed to avoid accumulation at the demolition site. Brush and other vegetative refuse from the clearing operations, will be delivered to the Convenience Center located at 11th and Stillwell where it will be disposed of by chipping or grinding and will be used as decorative mulch by DPW Roads and Grounds. The Contractor will dispose of all construction debris in the Woodlawn Road Landfill or the Convenience Center as noted below, unless he has received written permission to do otherwise. Materials that cannot be removed daily will be stored in areas specified by the Contracting Officer. No contractor salvage operations will be allowed. In the interest of occupational safety and health, the work will be performed in accordance with EM385-1-1, section 23, Demolition and other applicable sections

The contractor will provide written notification to Fort Campbell of specific demolition locations. The notice will be given two (2) weeks prior to demolition activities and will be provided to the Chief of Maintenance, Mrs. Judy Hudson through the Contracting Office representative.

1.3 SUBMITTALS

Government approval is required for SUBMITTALS with a "GA" designation; submittals having an "FIO" designation are for information only. The following will be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-18 Records

Work Plan; GA.

The procedures proposed for the accomplishment of the work will provide for safe conduct of the work, including procedures and methods to provide necessary supports, lateral bracing and shoring when required, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures will include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations in accordance with EM 385-1-1.

1.4 DUST CONTROL

The amount of dust resulting from demolition will be controlled in accordance with TN 1200-3-8-01 (fugitive dust) to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the

surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

1.5 PROTECTION

1.5.1 Protection of Personnel

During the demolition work the Contractor will continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, may be allowed to remain standing without additional bracing, shoring, or lateral support until demolished. The Contractor will ensure that no elements determined to be unstable are left unsupported and will be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.5.2 Protection of Existing Property

Before beginning any demolition work, the Contractor will survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor will take necessary precautions to avoid damage to existing items to remain in place, items to be reused, or items to remain the property 27 of the Government; any damaged items will be repaired or replaced as approved by the Contracting Officer at no additional cost to the Government. The Contractor will coordinate the work of this section with all other work and will construct and maintain shoring, bracing, and supports as required. The Contractor will ensure that structural elements are not overloaded and will be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.5.3 Protection from the weather

The interior of buildings to remain and salvageable materials and equipment will be protected from weather at all times

1.5.4 Protection of Trees

Trees within the project site which might be damaged during demolition and which are indicated to be left in place shall be protected by a 2 meter high fence . The fence will be securely erected to a minimum of 1.5 meters from the trunk of individual trees or follow the outer perimeter of branches for clumps of trees. Any tree designated to remain that is damaged during the work under this contract will be replaced in kind or as approved by the Contracting Officer.

1.5.5 Environmental Protection

The work shall comply with the requirements of section 01560.

1.6 BURNING

The use of burning at Fort Campbell for the disposal of refuse and debris will not be permitted.

1.7 USE OF EXPLOSIVES

The use of explosives will not be permitted.

1.8 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available in accordance with the specific phasing requirements.

1.9 MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for the work covered under this section of the specifications but will be considered a subsidiary obligation of the Contractor.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 EXISTING STRUCTURES

Existing structures indicated will be removed to 1.0 meter below grade. Interior walls, other than retaining walls and partitions, will be removed to 1.0 meter below grade. Basement slabs will be removed in full. Sidewalks, curbs, gutters, and street light bases will be removed as indicated.

3.2 UTILITIES

Disconnection of utility services, with related meters and equipment, are specified in the related sections. Existing utilities will be removed as indicated. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer will be notified prior to further work in that area.

3.3 FILLING

Holes, and other hazardous openings will be filled in accordance with Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS and Section 02225 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.4 DISPOSITION OF MATERIAL

3.4.1 Not Used

3.4.2 Not Used

3.4.3 Unsalvageable Material

All building demolition debris (nonhazardous) will be delivered to the construction/demolition landfill on Woodlawn Road for disposal. Operating hours of the landfill are 7:30 A.M. to 4:00 P.M. (last load will be accepted no later than 3:30 P.M.) Monday through Friday. All building debris, with the exceptions of hazardous waste, trees and soil, will be included. For disposal of trees or soil, contact DPW, Environmental Division through the Contracting Office representative. In the event hazardous waste is found to be present, and not generated by the contractor, contact DPW through the Contracting Office representative immediately as noted above. The contractor is responsible for the proper disposal of any and all hazardous wastes he generates off site according to Federal, State and local regulations which may apply. Costs of disposal will be the contractor's responsibility.

All wood with the exception of pallets should be delivered to the construction/demolition landfill on Woodlawn

Road. If there is an abundance of useable lumber to be disposed, that wood will be delivered to DRMO for salvage. The Woodlawn Road Landfill will not accept debris contaminated with wood pallets or cardboard (see paragraph 3.4.1 Salvageable Items and Materials). The Contractor is responsible for separation of these materials or transportation to an off-post landfill.

Hazardous waste, contaminated soil and other special waste not generated by the contractor will be transported to the Pollution Prevention Operations Yard and disposed in accordance with applicable regulations. Contact DPW, Environmental Division through the Contracting Office representative for instructions. The Contractor is responsible for proper disposal of hazardous waste he generates at Fort Campbell at an approved offsite disposal facility. The Contractor must have the disposal manifest signed by an authorized representative of DPW, Environmental Division. Documentation of proper disposal must be provided to Fort Campbell DPW. Hazardous materials partially used and remaining at the end of the contract will be retained by the Contractor and removed from the post.

Excess top soil and excavated materials shall not be mixed and will be transported to the Woodlawn Road Landfill where it will be stockpiled. Temporary stockpiles of gravel and / or sand are only to be located at the construction site only.

Inert materials (clay, top soil, gravel, asphalt, rock, etc.) will be transported to the Woodlawn Road Landfill where it will be stockpiled and disposed as directed by DPW, Environmental Division. For larger quantities (500 cubic yards or more), contact the DPW, Environmental Division through the Contracting Office representative.

Scrap rubber with the exception of tires will be delivered to the construction/demolition landfill on Woodlawn Road for disposal. Tires will be delivered to one of the convenience centers for recycling if they were generated by Fort Campbell.

The Contractor will remove from Fort Campbell the waste created by maintaining his equipment at Fort Campbell (used oil, used antifreeze, contaminated fuel, tires, etc.) and ensure that the waste is disposed in accordance with Federal, State and local regulations. The Contractor will be able, upon request, to show proof of the proper disposal.

Refuse generated on a project site (office waste, lunch bags, etc.) shall be transported to one of the Convenience Centers for disposal.

Dumpsters and compactors located throughout the post are for the convenience of the assigned organizations and are not to be used by the Contractor. The Contractor may make arrangements for dumpster services for their own convenience. No waste is to be brought into Fort Campbell for disposal.

Liquid waste will not be accepted at the Woodlawn Road Landfill. The Contractor will be responsible for the proper disposal of such waste.

Questions pertaining to disposal of items listed above or any other items not listed, please contact Fort Campbell DPW, through the Contracting Office representative.

3.5 CLEAN UP

Construction debris, empty paint cans and rubbish will be removed from the site daily and will not be allowed to accumulate. Debris will be removed and transported in a manner that prevents spillage on streets or adjacent areas. Vehicles used to transport material will be enclosed or have a suitable cover to avoid spills while in transit. Any material which falls from the vehicle while in transit will be cleaned up at the time of spillage. Local regulations regarding hauling and disposal will apply.

-- End of Section --

***** SAFETY PAYS *****

SECTION 02080

REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS

09/98

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) PUBLICATIONS:

ANSI Z9.2-79	Fundamentals Governing the Design and Operation of Local Exhaust Systems

CODE OF FEDERAL REGULATIONS (CFR) PUBLICATIONS:

40 CFR 61, Subpart A	General Provisions
40 CFR 61, Subpart M	National Emission Standard for Asbestos
40 CFR 241	Guidelines for the Land Disposal of Solid Wastes
40 CFR 257	Criteria for Classification of Solid Waste Disposal Facilities and Practices
29 CFR 1926.1101	OSHA Construction Industry Asbestos Standard
29 CFR 1910.120	OSHA Hazardous Waste Emergency Response Standard
29 CFR 1910 subpart I	OSHA Personal Protective Equipment Standard

NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH

Method 7400	Manual of Analytical Methods, 3rd Ed.,Vol. 1, Physical and Chemical Analysis Method (P&CAM)Fibers
Method 7402	Asbestos Fibers

UNDERWRITERS LABORATORIES, INC. (UL) PUBLICATIONS

UL 586 1986 High Efficiency Particulate, Air Filter

1.2 DESCRIPTION OF WORK

The work covered by this section includes the removal of an unspecified quantity of 10 inch (254 mm) transite water pipe and the tying into an existing transite water line. For specific quantities and descriptions refer to Sheets C109, C112, C115 and C116. All transite materials are assumed to be in a nonfriable condition. In the event friable materials are encountered the contractor will stop work notify and the COR immediately Although Category II materials (transite) removed intact are not regulated in the state of Kentucky (unless 35 cubic feet of crumbled ACM is generated), Fort Campbell considers all asbestos containing materials in excess of 1 % to be regulated materials. The work on this project includes handling of nonfriable asbestos containing materials (ACMs) which may be encountered during removal operations and the incidental procedures and equipment required to protect workers and occupants of the area. The work also includes the disposal of the removed asbestos-containing materials. Perform work in accordance with 29 CFR 1926.1101; 40 CFR 61, Subpart A; 40 CFR 61, Subpart M; and the requirements specified herein.

1.2.1 Asbestos Survey

No asbestos survey is known to have been performed.

1.2.2 Unidentified ACM

If suspect ACM not covered by the drawings or the specifications is encountered, the contractor will stop work and immediately notify the contracting officer. Upon direction from the contracting officer, the contractor may be required to conduct sampling and testing of these suspect materials in accordance with the Industrial Hygienist's recommended procedures.

1.3 DEFINITIONS

1.3.1 Aggressive method

Removal or disturbance of building material by sanding, abrading, grinding or other method that breaks, crumbles, or disintegrates intact Asbestos Containing Material (ACM).

1.3.2 Amended Water

Water containing a wetting agent or surfactant.

1.3.3 Area Monitoring

Sampling of asbestos fiber concentrations inside and out of the regulated area, which is representative of the airborne concentrations of asbestos fibers which may reach the breathing zone.

1.3.4 Asbestos

Includes chrysotile, amosite, crocidolite, tremolite , anthophyllite, actinolite, and any of these minerals that have been chemically treated and/or altered. For purposes of this standard, "asbestos" includes PACM, as defined below.

1.3.5 Asbestos Abatement Contractor

A business entity certified, licensed, or accredited by the state in which a response action involving asbestos-containing building material that is friable, or expected to become friable during the response action.

1.3.6 Asbestos Containing Material (ACM)

Any material containing more than one percent asbestos

1.3.7 Asbestos Fibers

Asbestos fibers having a length-to-diameter ratio of at least 3 to 1 and a length of 5 micrometers or longer as counted in the NIOSH Method 7400 or Method 7402 procedure using either phase contrast light microscopy (PCM) or transmission electronic microscopy (TEM).

1.3.8 Asbestos Permissible Exposure Limit (PEL)

Legally enforceable level of asbestos fibers in air set by the Occupational Safety and Health Association (OSHA),
as an eight (8) hour time weighted average (TWA) of asbestos fibers not to exceed 0.1 fibers per cubic centimeter of air as set forth in 29 CFR 1926 1101

1.3.9 Authorized Person

Any person authorized and required by work duties to be present in regulated areas.

1.3.10 Breathing Zone

A hemisphere forward of the shoulders with a radius of approximately 6 inches to 9 inches.

1.3.11 Category I Nonfriable ACM

Category I Nonfriable ACM includes asbestos-containing packing, gaskets, resilient floor covering, and asphalt roofing products.

1.3.12 Category II Nonfriable ACM

Category II Nonfriable ACM includes any asbestos-containing material not included in Category I that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

1.3.13 Certified Asbestos Supervisor

One certified by the State in which work is to be performed and has passed an examination covering "Supervision of Asbestos Abatement Projects" or similar title training. This training must be the equivalent in curriculum, training, method and length to the EPA Model Accreditation Program (MAP) asbestos abatement

workers training 40 CFR part 763 subpart E, Appendix C.

1.3.14 Certified Asbestos Worker

One certified by the National Asbestos Council and holds current cards illustrating the board number.

1.3.15 Certified Licensed Contractor

A Contractor who has been trained at an EPA approved course and certified/accredited by the state for which the work is to be performed in.

1.3.16 Certified Industrial Hygienist (CIH)

One certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.

1.3.17 Class I Asbestos Work

Activities involving the removal of Thermal System Insulation (TSI) and surfacing ACM and PACM.

1.3.18 Class II Asbestos Work

Activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but it not limited to, the removal of asbestos-containing wallboard, floor tile, sheeting, roofing, siding shingles, and construction mastics.

1.3.19 Class III Asbestos Work

Repair and maintenance operations, where "ACM," including thermal system insulation and surfacing material, is likely to be disturbed.

1.3.20 Clean Room

An uncontaminated, transitional room having facilities for storage of employees' street clothing and uncontaminated materials and equipment.

1.3.21 Competent Person

In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure and has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32 (f); in addition, for Class I and Class II work, one who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for project designer or supervisor, or its equivalent and, for Class II who is trained in an operations and maintenance (O&M) course developed by EPA (40 CFR 763 . 92 (a)(2)).

1.3.21 Critical Barrier

One or more layers of plastic sealed over all openings into a work area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in work area from migrating to an adjacent area.

1.3.23 Decontamination Area

An enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room which is used for the decontamination of workers, materials and equipment contaminated with asbestos.

1.3.24 Demolition

The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

1.3.25 Disturbances

Contact which releases fibers from ACM or PACM or debris containing ACM or PACM. This term includes activities that disrupt the matrix of ACM or PACM, render ACM or PACM friable, or generate visible debris. Disturbance includes cutting away small amounts of ACM and PACM, no greater than the amount which can be contained in one standard sized glove bag or waste bag in order to access a building component. In no event will the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or waste bag which will not exceed 60 inches in length and width.

1.3.26 Employee Exposure

That exposure to airborne asbestos fibers that would occur if the employee were not using respiratory protective equipment.

1.3.27 Encapsulant

A liquid material which can be applied to ACM which controls the possible release of asbestos fibers from the material either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components together (penetrating encapsulant).

1.3.28 Encapsulate

The process where by an encapsulant is applied to ACM to control the release of asbestos fibers into the air.

1.3.29 Equipment Room (Change Room)

A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

1.3.30 Excursion Limit

The contractor will ensure that no employee is exposed to an airborne concentration of asbestos in excess 1.0 fibers per cubic centimeter of air (1.0 f/cc) as averaged over a sampling period of 30 minutes.

1.3.31 Fiber

A particulate form of asbestos, 5 micrometers or longer, with a length-to-diameter ratio of at least 3 to 1.

1.3.32 Friable Asbestos Material

Material that contains more than one percent asbestos by weight which can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

1.3.33 Glovebag Technique

A method with limited applications for removing small sections of asbestos-containing material from HVAC ducts, short piping runs, valves, joints, elbows, and other nonplanar surfaces in a noncontained regulated area. The glovebag is constructed and installed in such a manner that it surrounds the object or material to be removed and contains all asbestos fibers released during the removal process. All workers who are permitted to use the glovebag technique must be highly trained, experienced and skilled in this method. Glovebag techniques must be performed in accordance with 29 CFR 1926.1101 which require at least two persons perform class I removals. Glovebags may not be moved along a piece of pipe.

1.3.34 Glovebag

An impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which material and tools may be handled. Glovebags will be made of 6 mil thick plastic and will be seamless at the bottom. Glovebags are for single use and must be smoke tested for leaks prior to usage.

1.3.35 HEPA Filter Equipment

High-efficiency particulate air (HEPA) filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining at least 99.97 percent of all mono-dispersed particles of 0. 3 micrometer diameter or larger.

1.3.36 Homogeneous Area

An area of surfacing material or thermal system insulation that is uniform in color and texture.

1.3.37 Intact

ACM which has not been crumbled, pulverized, or otherwise deteriorated so that it is no longer likely to be bound with its matrix.

1.3.38 Negative Initial Exposure Assessment

A demonstration based by the contractor , which complies with the criteria in paragraph (f)(2)(iii) of 29 CFR 1926.1101, that employee exposures during an operation are expected to be consistently below the PELs.

1.3.39 Nonfriable Asbestos Material

Material that contains asbestos in which the fibers have been locked in by a bonding agent, coating, binder, or other material so that the asbestos is well bound and may not release fibers in excess of the action level during any appropriate use, handling, storage, transportation, or processing. Nonfriable asbestos containing material must be removed prior to demolition/renovation. Nonfriable asbestos containing materials are to be disposed as special waste at the Woodlawn Road Landfill.

1.3.40 Presumed Asbestos Containing Material (PACM)

Thermal system insulation and surfacing material found in buildings constructed no later than 1980.

1.3.41 Personal Monitoring

Sampling of airborne asbestos fiber concentrations within the breathing zone of an employee.

1.3.42 Prior Experience

Experience required of the contractor, his employees, and his Industrial Hygienist on asbestos projects of similar nature and scope to insure capability of performing the asbestos removal in a satisfactory manner. Similarities will be in areas related to material composition, project size, number of employees and the engineering work practice and personal protection controls required.

1.3.43 Regulated Areas

Areas established to demarcate where Class I, II and III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work may accumulate; and a work area within which airborne concentrations of asbestos, exceed or there is a reasonable possibility they may exceed the permissible exposure limit.

1.3.43.1 Enclosed Regulated Area

A regulated area which has been isolated by physical boundaries and maintained under negative pressure to prevent the spread of asbestos dust, fibers, or debris. A local HEPA filtered exhaust system is required.

1.3.44 Regulated Asbestos-Containing Material (RACM) for abatement at Fort Campbell will include the following:

(a) Friable asbestos containing material

(b) All category I nonfriable ACM

© All category II nonfriable ACM

1.3.45 Thermal System Insulation (TSI)

ACM applied to pipes, fittings, boilers, breeching, tanks, ducts or other structural components to prevent heat loss or gain.

1.3.46 Thermal System Insulation ACM

Thermal system insulation which contains more than 1 percent asbestos.

1.3.47 Time Weighted Average (TWA)

The TWA is an individuals 8-hour time weighted average of airborne concentration of fibers per cubic centimeter of air.

1.4 SUBMITTALS

The following will be submitted in accordance with Section 01300 SUBMITTALS to and approved by the contracting officer prior to commencing work involving asbestos materials:

1.4.1 SD-01, Data

1.4.1.1 Local Exhaust Equipment;

1.4.1.2 HEPA Vacuum Equipment;

1.4.1.3 Respirators; including fit test records

1.4.1.4 Pressure Differential Monitor;

1.4.1.5 Hazardous Communication Plan (if hazardous materials will be brought onto site)

1.4.1.6 Training Data

Submit signed and dated certificates for each employee that has received training for the appropriate task(s) assigned and the required amount of hours for the proper handling of materials that contain asbestos, that the employee understands the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limitations of the respiratory equipment to be used; understands the results of monitoring of airborne quantities of asbestos as related to health and respiratory equipment; and understands engineering and other hazard control techniques and procedures.

1.4.2 SD-08 Statements

1.4.2.1 Testing Laboratory;

Submit the name, address, and telephone number of the testing laboratory selected to perform the monitoring, testing, and reporting of airborne concentrations of asbestos fibers along with certification that persons counting the samples have been judged proficient by successful participation within the last year in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing (PAT) Program. The laboratory will be accredited by the American Industrial Hygiene Association (AIHA). If bulk sample analysis is necessary the testing laboratory will have to submit their certification of NVLAB participation.

1.4.2.2 Industrial Hygienist;

Submit the name, address, and telephone number of the Industrial Hygienist selected to prepare the asbestos plan, direct monitoring and perform training, and a certification that the Industrial Hygienist is certified by the American Board of Industrial Hygiene, including certification number, and date, and their previous experience in asbestos removal activities. For the purposes of this specification the terms industrial hygienist, Certified Industrial Hygienist and CIH are synonymous. The industrial hygienist will be contracted by the abatement firm performing the work. In addition to being a CIH, the individual must be accredited in the discipline he is performing. The Industrial Hygienist must be an accredited building inspector if he is to collect samples or an accredited designer if he is to perform asbestos design specifications.

1.4.2.3 Prior Experience;

As evidence that the asbestos removal effort will be accomplished by trained and competent personnel totally familiar with safe and legal asbestos working practices, the contractor will furnish for Government approval (for himself or for his selected asbestos removal subcontractor) written documentation of successfully completed asbestos abatement projects of similar nature and scope. A short summary of three (3) asbestos abatement projects performed will include:

a. The name, address, and telephone number of the contact person(someone specifically familiar with the contractor's work). If available, include copies of letters of reference from previous users of the contractors service.

b. A short description of the type of removal (e.g. pipe lagging, sprayed girders and/or ceilings, transite siding, etc.), its extent (square feet, linear feet), and days to complete (scheduled and actual).

c. Documentation of any licenses or certifications as an asbestos abatement Contractor in the jurisdiction covered. If none, a negative response is required.

d. The contractor will certify that the firm and its employees are familiar with regulations of the Occupational Safety and Health Administration (OSHA) and the U.S. Environmental Protection Agency (EPA) cited in the project specification and related to asbestos abatement.

e. The contractor will further document that no RACM will be stripped, removed , or otherwise be handled or disturbed unless at least one on-site representative, such as a foreman, management level, or other authorized representative trained in the provisions of this regulation and the means of complying with them, is present. Annually the trained on-site individual will receive refresher training in the provisions of this regulation. The required training will include as a minimum: applicability; notifications; material identification; control procedures for removals including, at least, wetting, local exhaust ventilation, negative pressure enclosures, glove-bag procedures, and High Efficiency Particulate Air (HEPA) filters; waste disposal work practices; reporting and record keeping; and asbestos hazards and worker protection. Evidence that the required training has been completed will be posted and made available for inspection by the NESHAP administering agency at the demolition or renovation site.

f. A notarized statement, signed by an officer of the asbestos abatement company, containing the following information: (If none, a negative reply is required.)

(1) A record of any citations issued by Federal, State or local: regulatory agencies relating to asbestos abatement activity. Include projects, dates and resolutions.

(2) A list of penalties incurred through noncompliance with asbestos abatement project specifications including liquidated damages, overruns in scheduled time limitations and resolutions

(3) Situations in which an asbestos related contract has been terminated including projects, dates and reasons for terminations.

(4) A listing of any asbestos-related legal proceedings/claims which the contractor (or employees Scheduled to participated in this project) has participated or is currently involved. Include descriptions of role, issue and resolution to date.

1.4.2.4 Asbestos Plan;

Submit a detailed Plan of the work procedures to be used in the removal and disposal of materials containing asbestos. Include in the Plan an explanation of Initial Exposure Assessment. The Plan will be prepared, signed, and sealed, including certification number and date, by the contractor's Certified Industrial Hygienist. Such Plan will include a sketch showing the location, size, and details of regulated areas, location and details of the decontamination area, layout of decontamination area, and locations of local exhaust equipment. The Plan will also include interface of trades involved in the construction, sequencing of asbestos-related work, disposal plan, type of wetting agent to be used, air monitoring, respirators, protective equipment, pressure differential monitoring device, and a detailed description of the method employed in order to control ambient air conditions within the regulated area. All milestones and schedules will be included within this Plan. The Plan will be approved by the contracting officer prior to the start of any asbestos work. Prior to beginning work, the contractor will meet with the contracting officer to discuss in detail the Asbestos Plan, including work procedures and safety precautions.

1.4.2.5 Notification Requirements;

a. Initial Notification

At least 10 working days before asbestos stripping or removal work or any other activity begins such as site preparation that would break up, dislodge or similarly disturb asbestos containing materials.

The contractor will:

(1) Provide the U.S. Environmental Protection Agency (EPA) Regional NESHAP administering agency with the required notice of intention to demolish or renovate. Notification shall be in accordance with Kentucky Division of Air Quality Regulations and Code of Federal Regulations 40 CFR 61, Subpart M. The contractor will send notification forms to the Department for Environmental protection - Division of Air Quality Paducah regional Office 4500 Clarks River Road, Paducah, Kentucky. A Kentucky "Notification of Asbestos Abatement/Demolition/Renovation " form is located at the end of this section. Work will not commence on any dates other than those stated in the notification without renotification of all parties. Delivery of the notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable. The contractor will also provide the Contracting Office representative copies of all notifications and renotification.

(2) Update notice, as necessary, including when the amount of asbestos affected changes by at least 20 percent.

b. Renotification

For asbestos stripping or removal work in a demolition or renovation operation that will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the NESHAP-administering agency as follows:

(1) When the asbestos stripping or removal operation or demolition operation covered by this paragraph will begin after the date contained in the notice,

(a) Notify the NESHAP administering agency of the new start date by telephone as soon as possible before the original start date, and

(b) Provide the NESHAP administering agency with a written notice of the new start date as soon as possible before, and no later than, the original start date. Delivery of the updated notice by the U.S. Postal Service commercial delivery service, or hand delivery is acceptable.

(2) When the asbestos stripping and removal operation or demolition operation covered by this paragraph will begin earlier than the original start date, provide the NESHP administering agency with a written notice of the new start date at least 10 working days before asbestos stripping or removal work begins.

(3) In no event will an operation covered by this paragraph begin on a date other than the date contained in the written notice of the new start date.

c. Notification Information

The following will be included in the notice:

(1) An indication of whether the notice is the original or a revised notification.

(2) Name, address, and telephone number of both the facility owner and operator and the asbestos removal contractor.

(3) Type of operation: demolition or renovation.

(4) Address including specific building number and description of the facility or affected part of the facility including the size (square meters/square feet and number of floors), age, and prior use of the facility.

(5) Procedure, including analytical methods, employed to detect the presence of RACM and Category I and Category II nonfriable ACM.

(6) Estimate of the approximate amount of RACM to be removed from the facility in terms of length of pipe in linear meters (linear feet), surface area in square meters (square feet) on other facility components, or volume in cubic meters (cubic feet).

(7) Location of the facility being demolished or renovated.

(8) Scheduled start and completion dates of demolition or renovation.

(9) Description of planned demolition or renovation work to be performed and method(s) to be employed, including demolition or renovation techniques to be used and description of affected facility components.

(10) Description of work practices and engineering controls to be used to comply with the requirements of this subpart, including asbestos removal and waste-handling emission control procedures.

(11) Name and location of the waste disposal site where the asbestos-containing material will be deposited.

(12) A certification that at least one person trained as required by paragraph (e) of 1.4.2.3 of this section will supervise the stripping and removal described by this notification.

(13) Description of procedures to be followed in the event that unexpected ACMs are encountered.

(14) Name, address, and telephone number of the waste transporter.

1.4.3 SD-09, Reports

1.4.3.1 Monitoring Results;

Fiber counting will be completed and results reviewed by the Certified Industrial Hygienist within 16 hours. The CIH will notify the contractor and the contracting officer immediately of any exposures to fibers in excess of the acceptable limits. Submit monitoring results to the contracting officer within 3 working days, signed by the testing laboratory, the employee performing air monitoring and the CIH.

1.4.3.2 Local Exhaust System;

Local exhaust systems must be installed and operated in accordance with ANSI Z9.2-79. The local HEPA filtered exhaust system will be operated continuously, 24 hours a day, to maintain the enclosure under negative

pressure until the enclosure of the regulated area is removed. Pressure differential recordings for each workday will be reviewed by the Industrial Hygienist and submitted to the contracting officer within 24 hours from the end of each workday. The contractor will notify the contracting officer immediately of any variance in the pressure differential which could cause exposure of adjacent unsealed areas to asbestos fiber concentrations.

1.4.3.3 Job Progress Report;

During abatement activities, the Industrial Hygienist will submit a weekly job progress report to the contracting officer detailing abatement activities. Include review of progress with respect to Asbestos Plan, milestones and schedules, major problems and actions taken, injury reports, equipment breakdowns and a compilation of the weeks bulk material and air sampling results conducted by the contractor's Industrial Hygienist or air sampling professional. Submission of individual monitoring results will be as dictated by SD-09, Reports. The progress report will be signed by the contractor, asbestos abatement subcontractor and the Industrial Hygienist.

1.4.4 SD-13, Certificates

1.4.4.1 Local exhaust and HEPA vacuum filters;

Local exhaust and HEPA vacuum filters need to be maintained as per manufacturers specifications. Asbestos prefilters need to be replaced daily and HEPA filters changed based upon daily readings of the manometer as described in section 2.7 of this specification.

1.4.4.2 Respirators;

Respiratory protection will be provided by the contractor according to 29 CFR 19261101.and the requirements specified in section 2.2 of this specification. The contractor will have developed and implemented a respiratory protection program meeting all the requirements of 29 CFR 1910.134 OSHA’s Respiratory Protection Standard.

1.4.5 SD-18, Records

1.4.5.1 Landfill Delivery Records;

Submit written evidence that the contractor plans to use the Woodlawn Road Landfill for disposal and will follow all approved procedures for asbestos disposal issued by the EPA, state and local regulatory agencies. Submit copies of all waste shipment records and resulting correspondence. An asbestos waste shipment record appears at the end of this specification.

1.5 TITLE TO MATERIALS

Materials resulting from demolition work, except as specified otherwise, will become the responsibility of the contractor and will be disposed of as specified herein.

1.6 PROTECTION OF EXISTING WORK TO REMAIN

Perform demolition work without damage or contamination of adjacent work. Where such work is damaged or contaminated, restore work to the original condition at no additional cost to the government.

1.7 SEQUENCE OF WORK

No other work shall be performed in the asbestos regulated area prior to completion and certification of the asbestos abatement work.

1.8 PERMISSIBLE EXPOSURE LIMITS (PELS)

a. Time-weighted average limit (TWA). Ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 fiber per cubic centimeter of air as an eight (8) hour time-weighted average (TWA).

b. Excursion limit. Ensure that no employee is exposed to an airborne concentration of asbestos in excess of 1.0 fiber per cubic centimeter of air (1.0 f/cc) as averaged over a sampling period of thirty (30) minutes.

1.9 MEDICAL SURVEILLANCE 29 CFR 1926.1101(m)

1.9.1 Medical examinations

Submit evidence of a medical surveillance program for all employees who for a combined total of 30 or more days per year are engaged in Class I, II and III work or are exposed at or above the permissible exposure limit or excursion limit, and for employees who wear negative pressure respirators. The content of the examination shall be consistent with 29 CFR 1926.1101 (m). This examination is not required if adequate records show the employee has been examined as required by 29 CFR 1926.1101 (m) within the past year. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos fibers and within 30 calendars days before or after the termination of employment in such occupation.

1.9.2 Medical Records

Maintain complete and accurate records as required by 29 CFR 1926.1101(n) employees' medical examinations for a period of at least 40 years after termination of employment and make records of the required medical examinations available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health, The Director of the National Institute for Occupational Safety and Health (NIOSH), authorized representatives of either, and an employee's physician upon the request of the employee or former employee.

l.l0 TRAINING

All workers must receive training specific to the tasks performed on the project. In addition, each employee must have received an equivalent level of training within 3 months prior to assignment to asbestos work or shall be instructed for a minimum of 8 hours by the CIH with regard to the methods of recognizing asbestos; the health effects associated with asbestos; the relationship between smoking and asbestos in producing lung cancer; its purposes, proper use, fitting instructions, and limitations of respirators; the nature of operations that could result in exposure to asbestos, the importance of necessary protective controls to minimize exposure and any necessary instructions in the use of these controls and procedures; the appropriate work practices for performing the asbestos removal job; medical surveillance program requirements; and a review of 29 CFR 1926.58 safety and health precautions and the use and requirements for protective clothing and equipment including respirators. Fully cover engineering and other hazard control techniques and procedures. Maintain complete and accurate records of training for each employee. Records shall be maintained for one year beyond the last date of employment.

Employees who perform Class I or Class II removals will have received the EPA worker 4-day course.

Supervisors will have received the EPA 5-day Competent person training.

1.12 PERMITS

Obtain necessary permits in conjunction with this project for the abatement, demolition, transportation and disposal of asbestos containing materials, and provide timely notification of such actions as may be required by Federal, State, regional, and local authorities. Refer, also, to SD-18, Records (Landfill Delivery Records) for additional requirements.

1.13 SAFETY AND HEALTH COMPLIANCE

In addition to detailed requirements of this specifications, comply with laws, ordinances, rules, and regulations of Federal, State, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.1101 and 40 CFR 61, Subpart A and 40 CFR 61, Subpart M. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where specification requirements and referenced documents vary, the most stringent requirements will apply.

PART 2 PRODUCTS

2.1 EQUIPMENT AND MATERIAL USED IN REMOVAL OPERATIONS

Furnish the contracting officer with two complete sets of personal protective equipment, as required herein, for each entry into and inspection of the regulated area.

2.2 RESPIRATORS

The contractor will provide respirators , and ensure they are used in the following circumstances. Respiratory protection is required on all asbestos abatement jobs.

a. During all class I removal jobs.

b. During all class II work where the ACM is not removed in a substantially intact state.

c. During all Class II and III work which is not performed using wet methods, provided, however that respirators need not be worn during removal of sloped roofs when a negative exposure assessment has been made and the ACM is removed in an intact state.

d. During all Class II and III asbestos jobs where the contractor does not produce a “negative exposure assessment.”

e. During all Class III jobs where TSI or surfacing ACM or PACM is to be disturbed.

f. During all Class IV work performed in regulated areas where employees performing other work are required to wear respirators.

g. During all work where employees are exposed above the PEL or the excursion limit.

h. During emergencies.

Select respirators approved by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in

atmospheres containing asbestos fibers according to the table below. During the performance of work when removal or demolition of asbestos materials is not underway and after the TWA and ceiling limits have been established, the contractor shall provide respirators as required in 29 CFR 1926.1101(h). The contractor shall establish a respirator program as required by ANSI Z88.2-80 and 29 CFR l910.134.

RESPIRATORY PROTECTION FOR ASBESTOS FIBERS

Airborne concentration of asbestos or condition of use	Required respirator
Not in excess of 1 f/cc (l0XPEL), or otherwise as required independent of exposure	Half-mask air purifying respirator other than a disposable, equipped with high efficiency filters.
Not in excess of 5 f/cc (50XPEL).	Fullface piece air-purifying respirator equipped with high efficiency filters.
Not in excess of 10 f/cc (100XPEL).	Any powered air-purifying respirator equipped with high efficiency filters or any supplied air respirator operated in continuous flow mode.
Not in excess of 100 f/cc (100XPEL)	Fullface piece supplied - air respirator operated in pressure demand mode.
Greater than 100 f/cc in (1,000XPEL), or unknown concentration.	Fullface piece supplied air respirator operated pressure demand mode, equipped with an auxiliary positive pressure self contained breathing apparatus.

*Airborne concentrations are based upon the 8 hour TWA - PEL

*A high efficiency filter means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers in diameter or larger.

*Air purifying respirators must be equipped with high-efficiency particulate air (HEPA) filters. The HEPA filters are not reusable.

In addition to the above selection criteria the contractor will provide tight fitting powered air purifying respirators equipped with high efficiency filters or a full face piece supplied air respirator operated in the pressure demand mode equipped with HEPA egress cartridges or an auxiliary positive pressure self contained breathing apparatus for all employees within the regulated area where Class I work is being performed for which a negative exposure assessment has not been produced and the exposure assessment indicates the level will not exceed 1 f/cc as an 8- hour time weighted average. A full face piece supplied air respirator operated in the pressure demand mode equipped with an auxiliary positive pressure self-contained breathing apparatus shall be provided under such conditions, if the exposure assessment indicates exposure levels above 1.0 f/cc as an 8-hour time weighted average.

2.3 SPECIAL CLOTHING

2.3.1 Protective Clothing

Protective clothing shall be coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings.

2.3.2 Work Clothing

Provide boot covers and cloth work clothes to be worn under the protective coveralls.

2.4 HYGIENE FACILITIES

A decontamination area shall consist of an equipment room, shower area, and clean room in series. The equipment room shall be supplied with impermeable, labeled bags and containers for the containment and disposal of contaminated protective equipment. Shower facilities shall be provided which comply with 29 CFR l910.14(d)(3). The clean change room shall be equipped with a locker or appropriate storage container for each employee's use.

2.5 EYE PROTECTION

Provide goggles for personnel engaged in asbestos operations when the use of a full face respirator is not required.
Eye protection will be provided as per 29 CFR 1910.133 OSHA's Eye and Face Protection Standard.

2.6 WARNING SIGNS AND LABELS

2.6.1 Warning Signs

Warning signs must be of sufficient size to be clearly legible and display the following information:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

2.6.2 Warning Labels

Labels must be of sufficient size to be clearly legible, printed in large, bold letters on a contrasting background, and displaying the following legend:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

2.7 LOCAL EXHAUST SYSTEM

Provide a local exhaust system in the enclosed regulated areas. Filters on vacuums and exhaust equipment will be UL 586-labeled HEPA filters. Local exhaust equipment shall be sufficient to maintain a minimum pressure differential of minus 0.02 inches of water column relative to adjacent, unsealed areas. The local exhaust system must be equipped with a manometer-type negative pressure differential monitor with minor scale division of 0.02 inches of water and accuracy within plus or minus 10 percent. The manometer must be calibrated daily as recommended by the manufacturer. Provide manually recorded manometer readings of the pressure differential between the enclosed regulated area and adjacent unsealed areas at the beginning of each workday and every 2 working hours thereafter. The local exhaust system will be operated continuously, 24 hours per day, until the regulated area enclosure is removed. Replace filters as required to maintain the efficiency of the system. The building heating, ventilating, and air-conditioning (HVAC) system will not be used as the local exhaust system for the enclosed regulated area.

2.8 TOOLS AND MISCELLANEOUS EQUIPMENT

2.8.1 Airless Sprayer

An airless sprayer, suitable for application of sealing material, will be used.

2.8.2 Scaffolding

Scaffolding, as required to accomplish the specified work, shall meet all applicable safety regulations.

2.8.3 Transportation Equipment

Transportation equipment, as required, will be suitable for loading, temporary storage, transporting, and unloading of contaminated waste without exposure to persons or property.

2.8.4 Vacuum Equipment

All vacuum equipment utilized in the work area will utilize HEPA filtration systems.

2.8.5 Water Sprayer

The water sprayer will be an airless or other low pressure sprayer for amended water application.

2.8.6 Other Tools and Equipment

The contractor shall provide other suitable tools for the stripping, removal, encapsulation and disposal activities including but not limited to: knives, stiff nylon brushes, sponges, rounded edge shovels, brooms, and carts.

2.9 MATERIALS

2.9.1 Lockdown Sealant

The sealing agent will be penetrating sealants and will meet the following criteria:

a. They will withstand most impact or abrasion and protect the surface.

b. Sealants selected for use by the contractor will be one of those demonstrating probable effective

performance under the tests conducted by an independent testing laboratory and are approved by the contracting officer.

c. They will have high flame retardant characteristics, and a low toxic fume and smoke emission rating.

d. They will not be noxious or toxic to application workers, or subsequent workers in the area.

e. They will have some permeability to water vapor to prevent condensation accumulation, and resist solution by common cleaning agents. They will be water insoluble when cured.

f. They will be acceptable weathering and aging characteristics.

g. They will be acceptable by architectural standards.

h. They will be compatible with all insulating material likely to be applied to the stripped surfaces.

I. They will be demonstrably capable of adhering to the surfaces of the substrate.

j. They must contain a light blue or red paint tint. (Food coloring is not acceptable.)

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Respirator Program.

Submit evidence of a respirator program as required by ANSI Z88.2 and 29 CFR 1910.134.

3.1.2 Protective Clothing

Provide and require the use of protective clothing for any employee exposed to airborne concentrations of asbestos that exceed the TWA and/or excursion limit, or for which a required negative exposure assessment is not produced, and for any employee performing Class I and II operations (other than roofing felts and mastics) which involve the removal of over 25 linear or 10 square feet of TSI or surfacing ACM and PACM.

3.1.3 Hygiene Facilities

For employees performing Class I work involving over 25 linear or 10 square feet of TSI or surfacing ACM and PACM, establish a decontamination area that consists of an equipment room, shower area, and clean room in series. Ensure that employees enter and exit the regulated area through the decontamination area. Where it is demonstrated that it is not feasible to locate the shower between the equipment room and the clean room, or where work is performed outdoors, ensure that employees remove asbestos contamination from their work suits in the equipment room using a HEPA vacuum before proceeding to a shower.

3.1.4 Warning Signs and Labels

Provide warning signs at approaches to regulated areas containing airborne asbestos fibers. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to asbestos materials, scrap, waste, debris, and other products contaminated with asbestos.

3.1.5 Accessibility of Work Areas

The Government will rearrange areas to the extent of providing a reasonable, direct, and an unobstructed path to the work sites. During asbestos removal, the Contractor will confine his equipment and employee pattern to these designated areas. Where the building is still occupied during the removal operations, interference with the functional operation of the building occupants outside these areas will not be permitted. Where conflicts arise due to Contractor's operations, the decision of the Contracting officer or his authorized representative will be final.

3.1.6 Preparation for Removal

3.1.6.1 Movable Furnishings

Movable furnishings, equipment and fixtures in the work area will be pre-cleaned and removed from the area of work by the Government before asbestos work begins.

3.1.6.2 Pre-Cleaning

All wall and floor surface areas, other than those from which asbestos is to be removed, and all non-movable furnishings, equipment, and fixtures remaining in the work area will be pre-cleaned with a HEPA filter equipped vacuuming device or wet cleaning methods prior to sealing with plastic sheeting. Do not use any methods which would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. After pre-cleaning, enclose fixed objects in 6-mil polyethylene sheeting, label, and seal securely with tape, objects which must remain in the work area and that require special ventilation or enclosure requirements will be suitably protected as approved by the contracting officer. Items in the work area which may require access by user during abatement will be designated during the pre-abatement walkthrough and enclosures constructed with access flaps sealed with waterproof tape.

3.1.7 Regulated Areas

All Class I, II, and III asbestos work will be conducted within regulated areas. The regulated area will be demarcated in any manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne concentrations of asbestos. Where critical barriers or negative pressure enclosures are used, demarcate the regulated area. Signs will be provided and displayed pursuant to 29 CFR 1026.1101(k)(6). Access to regulated areas will be limited to authorized persons. All persons entering a regulated area where employees are required to wear respirators, will be supplied with a respirator. All asbestos work performed within regulated areas will be supervised by a competent person.

3.1.7.1 Enclosed (Critical Barrier) Regulated Area Requirements

Seal openings in areas where the release of airborne asbestos fibers is expected. Establish a regulated area with the use of curtains, portable partitions, or other enclosures in order to prevent the escape of asbestos fibers from the contaminated area. The established regulated area will be provided with protective covering of walls and ceilings with a continuous membrane of two layers of minimum 6-mil plastic sheeting sealed with tape to prevent water or other damage and two layers of 6-mil plastic sheeting over floors extending a minimum of 24 inches up walls. All penetrations of the floor, walls, and ceiling will be sealed with 6-mil polyethylene plastic and duct tape. Seal joints using spray adhesive and duct tape. Openings will be allowed in enclosures of regulated areas for the supply and exhaust of air for the local exhaust system.

3.2 ASBESTOS ABATEMENT PROCEDURES

3.2.1 Initial Exposure Assessment

Ensure that a "competent person" conducts an exposure assessment immediately before or at the initiation of

the operation to ascertain expected exposures during that operation or workplace. The assessment must be completed in time to comply with requirements which are triggered by exposure data or the lack of a "negative exposure assessment," and to provide information necessary to assure that all control systems planned are appropriate for that operation and will work properly.

An Initial Exposure Assessment will be conducted in accordance with 29 CFR 1926.1101

For Class I asbestos work, until exposure monitoring is conducted, and is documented that employees on the job will not be exposed in excess of the PELs, or otherwise makes a negative exposure assessment, it is presumed that employees are exposed in excess of the TWA and excursion limit. A negative exposure assessment can only be obtained by demonstrating requirements contained in 29 CFR 1926.1101.

3.2.2 Monitoring Requirements

Perform exposure monitoring as required to determine accurately the airborne concentrations of asbestos to which employees are exposed. Determinations of employee exposure will be made from breathing zone air samples that are representative of the 8-hour TWA and 30-minute short-term exposures of each employee. Representative 8-hour TWA employee exposure will be determined on the basis of one or more samples representing full-shift exposure for employees in each work area. Representative 30-minute short-term employee exposures will be determined on the basis of one or more samples representing 30-minute exposures associated with operations that are most likely to produce exposures above the excursion limit for employees in each work area.

3.2.2.1 Monitoring Prior to Asbestos Work

Provide area monitoring and establish the reference TWA l day prior to the masking and sealing operations for each asbestos removal site. The reference TWA is determined by taking at least three general area air samples in each asbestos regulated area.

3.2.2.2 Periodic monitoring

Conduct daily monitoring that is representative of the exposure of each employee who is assigned to work within a regulated area who is performing Class I or II work unless a negative exposure assessment for the entire operation has been made. Conduct periodic monitoring of all work where exposures are expected to exceed a PEL at intervals sufficient to document the validity of the exposure prediction. When all employees required to be monitored daily are equipped with supplied-air respirators operated in the positive-pressure mode, daily monitoring is not required. However employees performing Class I work using a control method which is not listed in Class I Requirements paragraph, will continue to be monitored daily even if they are equipped with supplied-air respirators.

3.2.2.3 Monitoring Adjacent Areas Prior to Asbestos Work

Provide area monitoring and establish the reference TWA inside the building outside the enclosed regulated area l day prior to beginning asbestos work.

3.2.2.4 Termination of Monitoring

If the periodic monitoring reveals that employee exposures, as indicated by statistically reliable measurement, are below the PEL and excursion limit, monitoring may be discontinued for those employees whose exposures

are represented by such monitoring. Institute additional monitoring whenever there has been a change in process, control equipment, personnel or work practices that may result in new or additional exposures above the PEL and/or excursion limit.

3.2.3 Respiratory Protection

Respirators will be provided and used according to the requirements of 29 CFR 1926.1101 and section 2.2 of this specification.

3.2.4 Controls and Work Practices

The following controls and work practices will be used in all classes of work regardless of levels of exposure:

a. Vacuum cleaners equipped with HEPA filters to collect all debris and dust containing ACM or PACM;

b. Wet methods, or wetting agents, to control employee exposures during asbestos handling, mixing, removal, cutting, application, and cleanup, except where demonstrated that the use of wet methods are infeasible;

c. Prompt clean-up and disposal of wastes and debris contaminated with asbestos in leak-tight container;

d. Local exhaust ventilation equipped with HEPA filter dust collection systems;

e. Enclosure or isolation of processes producing asbestos dust;

f. Ventilation of the regulated area to move contaminated air away from the breathing zone and toward a filtration or a collection device equipped with a HEPA filter.

The following work practices and controls <u>will not be</u> used for work related to asbestos or the work which disturbs ACM or PACM, regardless of measured levels of asbestos exposure or results of the initial exposure assessments:

a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filters exhaust air;

b. Compressed air used to remove asbestos, or ACM, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air;

c. Dry sweeping, shoveling or other dry clean-up and debris containing ACM and PACM;

d. Employee rotation as a means of reducing employee exposure to asbestos.

3.2.5 Class I Abatement Requirements

In addition to all provisions required in control and work methods above, the following controls and work practices will be used for all Class I work.

a. Installation and operation of the control systems, will be supervised by a competent person.

b. Work involving the removal of more than 25 linear or 10 square feet of thermal system insulation or surfacing material; for all other Class I jobs, where a negative exposure assessment, or where employees are working in areas adjacent to the regulated area, while the Class I work is being performed, use one of the following methods to ensure that airborne asbestos does not migrate from the regulated areas:

(1) Critical barriers will be placed over all openings to the regulated area;

(2) Use another barrier or isolation method which prevents the migration of airborne asbestos from the regulated area, as verified by perimeter area surveillance during each work shift at each boundary of the regulated area, showing no visible asbestos dust; and perimeter area monitoring showing that clearance levels contained in 40 CFR Part 763, Subpart 3, or that perimeter area levels are no more than background levels representing the same area before the asbestos work began.

c. HVAC systems will be isolated in the regulated area by sealing with a double layer of 6 mil plastic or the equivalent;

d. Impermeable dropcloths will be placed on surfaces beneath all removal activity;

e. All objects within the regulated area will be cleaned out and covered with impermeable dropcloths or plastic sheeting which is secured by duct tape or an equivalent.

f. Where a negative exposure assessment cannot be produced, or where exposure monitoring shows that a PEL is exceeded, ventilate the regulated area to move contaminated air away from the breathing zone of employees toward a HEPA filtration or collection device.

3.2.5.1.1 Vinyl and Asphalt Flooring Materials

For removing vinyl and asphalt flooring materials which contain ACM in buildings constructed no later than 1980:

a. Flooring or its backing will not be sanded.

b. Vacuums equipped with HEPA filter, disposable dust bag, and metal floor tool (no brush) will be used to clean floors.

c. Resilient sheeting will be removed by cutting with wetting of the snippoint and wetting during delamination. Rip-up of resilient sheet floor material is prohibited.

d. All scraping of residual adhesive and/or backing will be performed using wet methods.

e. Dry sweeping is prohibited.

f. Mechanical chipping is prohibited unless performed in a negative pressure enclosure which meets the requirement of this section.

g. Tiles will be removed intact, unless it is demonstrated that intact removal is not possible.

h. When tiles are heated and can be removed intact, wetting may be omitted.

I. Resilient flooring material including associated mastic and backing will be assumed to be

asbestos-containing materials unless an industrial hygienist determines them to be non asbestos containing materials using recognized analytical techniques.

J. Splash guards consisting of 6 mil polyethylene sheeting will be utilized when chemical strippers are used . Splash guards will extend along the wall from the floor to a height of 4 feet.

3.2.5.1.2 Any other Removal of ACM

a. The material will be thoroughly wetted with amended water prior and during its removal.

b. The material will be removed in an intact state unless the employer demonstrates that intact removal is not possible.

c. Cutting, abrading, or breaking the material will be prohibited unless the employer can demonstrate that methods less likely to result in asbestos fiber release are not feasible.

d. ACM removed will be immediately bagged or wrapped, or kept wetted until transferred to a closed receptacle, no later than the end of the work shift.

3.2.5.3 Asbestos Contaminated Soil

Any area of contaminated soil is to be removed of by the following procedures:

a. Before the soil removal commences, mark the wall in the area(s) at the existing ground elevation.

b. Using small shovels, all loose soil will be removed to a minimum depth of 3 inches.

c. Verification of the depth will be made by measurement from the excavation floor to the bottom of the original ground elevation mark or the wall.

3.3 COLLECTION

3.3.1 Nonfriable Non-Regulated Asbestos Containing Material (Non-RACM)

The non-friable ACM found in this project will be handled as RACM and will require special collection action as detailed in Para. 3.3.2.

The notification requirements of Para. 1.4.2 also are applicable to Non-RACM.

3.3.2 Regulated Asbestos Containing Material (RACM)

All asbestos containing materials for this project will be treated as RACM due to the nature of the materials present. Asbestos containing material will be removed in manageable sections and maintained in a wet condition. Material should be containerized upon removal and before being moved to any new location.

Maintain surfaces of the regulated area free of accumulations of asbestos fibers. Restrict the spread of dust and debris; keep waste from being distributed over the general area. Do not dry sweep or blow down the space with compressed air.

Collect asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing which may produce airborne concentrations of asbestos fibers; place in sealed impermeable bags imprinted with a

caution label (Para. 2.6.2) and label with the name of the contractor and the location at which the waste was generated. The sealed bags will then be placed in a second sealed impermeable bag also imprinted with the warning label. Bags will be placed in asbestos roll off boxes for shipment to the landfill.

3.3.2.1 Removing Material Intact

Asbestos containing materials should be removed intact whenever possible (removal of pipe and pipe insulation by wrapping, sealing the insulation and cutting the uninsulated ends of the pipe). Asbestos containing materials will not be dropped or thrown to the ground. Materials between 15 and 50 feet above the ground may be containerized at elevated levels or placed into inclined chutes or scaffolding for subsequent collection and containerization. Asbestos materials in open containers will be kept wet at all times.

3.3.2.2 Containers

Containers (drums or 6-mil polyethylene bags) will be sealed when full. Wet material will be heavy and double bagging of waste material is required. Bags, if used, will not be overfilled. They should be securely sealed to prevent accidental opening and leakage by tying the tops of the bags in an overhand knot or by taping in goose neck fashion. Do not seal bags with wire or cord. Bags may be placed in drums for staging and transportation to the landfill. Bags will be decontaminated on exterior surfaces by wet cleaning before being placed in clean drums and sealed with locking ring tops. Where unusual circumstances prohibit use of plastic disposal bags or drums, the contractor will submit, in the asbestos plan, an alternate proposal for removal, containerizing, and disposal of the asbestos containing materials.

3.3.2.3 Sharp Edged Components

Asbestos containing or contaminated waste with sharp edged components (e.g. nails, screws, metal lath, tin sheeting) that could otherwise tear polyethylene bags will be placed into drums for disposal.

3.3.2.4 Asbestos Contaminated Soil

Any removed soil will be placed in 6-mil plastic bags, sealed and then placed in approved containers such as fiber waste drums for disposal. Do not overfill plastic bags.

3.3.2.5 Wastewater

a. Pre-filtering. Any water produced by the decontamination of either equipment or persons will be (1) collected, (2) filtered through a system capable of trapping particles 5 microns and larger, specifically designed to remove asbestos fibers, and (3) filtrate disposed into a local sanitary sewer system.

b. Filter System. The filtration system will contain a series of several filters with progressively smaller pore sizes to avoid rapid clogging of the system by large particles. Disposable filters will be treated as asbestos waste.

3.4 DISPOSAL OF ACM

3.4.1 All Asbestos Containing Materials

1.Prior to delivery of asbestos containing materials at the Woodlawn Road Landfill the contractor will provide Fort Campbell, DPW Roads and Grounds at least 24 hours notice of when ACM is to be disposed.

2. Once drums, bags and otherwise containerized asbestos containing materials have been removed from the work area, they will be loaded into an enclosed truck for transportation to the Woodlawn Road landfill. Asbestos waste will not be allowed to be placed in trucks with non-asbestos waste. All bags utilized will be of 6-mil polyethylene and must be double lined.

3. All containers will be labeled according to the requirements of 29 CFR 1910.1200 OSHA Hazardous Communication Standard and will contain the following:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

4. The enclosed cargo area of the truck will be free of debris and lined with 6-mil polyethylene sheeting to prevent contamination from leaking or spilled containers. Floor sheeting will be installed first and extend up the sidewalls. Wall sheeting will be overlapped and taped into place so that no materials may escape to the environment.

5. Drums will be placed on level surfaces in the cargo area and packed tightly together to prevent shifting and tipping. Do not throw containers into the cargo area.

6. Personnel loading asbestos containing waste will be protected by disposable clothing including head, body and foot protection and at a minimum, half-face piece, air purifying, dual cartridge respirators equipped with high efficiency particulate air (HEPA) filters.

7. Large steel dumpsters (roll-off boxes) may be used for asbestos waste disposal. These should be lined with polyethylene and should have doors, tops or covers that can be closed to prevent vandalism or other disturbance of the containerized asbestos debris and wind dispersion of asbestos fibers. Uncontainerized asbestos materials will not be placed in these type dumpsters, nor will they be used for non-asbestos waste. Bags will be placed, not thrown, into these containers to avoid splitting.

8. Disposal of waste asbestos material at Woodlawn Road Landfill. Contact Fort Campbell-DPW, Environmental Division through the Contracting Officers representative.

9. For temporary storage, store sealed impermeable bags in asbestos waste drums. If temporary storage is within regulated areas and under negative pressure drums are not required. An area for interim storage of asbestos waste-containing drums will be assigned by the contracting officer or by an authorized representative. This area must be secure. No ACM wastes, except those properly labeled and properly containerized and physically located in the assigned holding area will be allowed to remain at the site overnight.

10. Procedures for hauling and disposing will comply with 40 CFR 61 Subpart M, 40 CFR 241, 40 CFR 257, and State, regional and local standards. Vehicles used to transport asbestos containing waste material must be clearly marked. The markings must:

(I) Be displayed in such a manner and location that a person can easily read the legend.

(ii) Conform to the requirements for 51 cm x 36 cm (20 in. x 14 in.) upright format signs specified in 29 CFR 1910.145(d)(4) and this paragraph; and

(iii) Display the following legend in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this paragraph.

Legend

DANGER
ASBESTOS DUST HAZARD
CANCER AND LUNG DISEASE HAZARD
Authorized Personnel only

Notation
2.5 cm (1 inch) Sans Serif, Gothic or Block
2.5 cm (1 inch) Sans Serif, Gothic or Block
1.9 cm (3/4 inch) Sans Serif, Gothic or Block
14 Point Gothic

Spacing between any two lines must be at least equal to the height of the upper of the two lines.

11. Upon reaching the landfill, trucks are to approach the dump location as closely as possible for unloading of the asbestos containing waste.

12. Bags, drums and components will be inspected as they are off loaded at the disposal site. Material in damaged containers will be repacked in empty drums or bags as necessary. Uncontaminated drums may be recycled.

13. Waste containers will be placed on the ground at the disposal site, not pushed or thrown out of trucks since the weight of wet material could rupture containers.

14. Personnel off-loading containers at the disposal site will wear protective equipment consisting of disposable head, body and foot protection and, at a minimum, half-face piece, air-purifying, dual cartridge respirators equipped with high efficiency particulate air (HEPA) filters. Following the removal of all containerized waste, the truck cargo area will be decontaminated to meet the no visible residue criteria. Polyethylene sheeting will be removed and discarded along with contaminated cleaning materials and protective clothing, in bags or drums at the disposal site. If landfill personnel have not been provided with personal protective equipment for the compaction operation by the landfill operator, the contractor will supply protective clothing and respiratory protection for the duration of this operation.

15. Shipment Records

a. Maintain waste shipment records, using copies of the form located at the end of this section and include the following information:

(I) The name, address, and telephone number of the waste generator.

(ii) The name and address of the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program.

(iii) The approximate quantity in cubic meters (cubic feet).

(iv) The name and telephone number of the disposal site operator.

(v) The name and physical site location of the disposal site.

(vi) The date transported.

(vii) The name, address, and telephone number of the transporter(s).

(viii) A certification that the contents of this consignment are fully and accurately described by proper shipping name and are classified, packed, marked, labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.

b. Provide a copy of the waste shipment record, described above to the disposal site owners or operators at the same time as the asbestos-containing waste material is delivered to the disposal site.

c. For waste shipments where a copy of the waste shipment record, signed by the owner or operator of the designated disposal site, is not received by the contractor within 35 days of the date the waste was transported, contact the owner or operator of the designated disposal site to determine the status of the waste shipment. The contractor will report in writing to the NESHAP administering agency if a copy of the waste shipment record, signed by the owner or operator of the designated waste disposal site, is not received by the contractor within 45 days of the date the waste was transported. Include in the report the following information:

(I) A copy of the waste shipment record for which a confirmation of delivery was not received, and

(ii) A cover letter explaining the efforts taken to locate the asbestos waste shipment and the results of those efforts.

d. Retain a copy of all waste shipment records, including a copy of the waste shipment record signed by the owner or operator of the designated waste disposal site, for at least 2 years.

e. Provide to the contracting officer within 3 working days following delivery of asbestos containing waste material copies of all waste shipment records. Also within 3 working days of initiation, provide to the contracting officer copies of any correspondence with the NESHAP administering agency.

Furnish upon request, and make available for inspection by the NESHAP administering agency, all records under this section.

3.4.2 Wastewater

It is the contractor's responsibility to comply with any local wastewater systems' regulations or policy regarding the disposal of wastewater from asbestos abatement activities.

3.5 CLEANUP AND FINAL CLEARANCE

3.5.1 Cleanup

Clean all surfaces in the work area and other contaminated areas with water and/or HEPA vacuum equipment. After cleaning the work area, allow 24 hours for settlement of dust and wet clean or clean with HEPA vacuum equipment all surfaces in the work area. When asbestos removal, disposal, and cleanup are complete, the contractor will certify, in writing, that the area is free of any asbestos material or debris.

3.5.2 Visual Inspection After Cleanup

Prior to the performance of final air monitoring, the contractor and the contracting officer or his representative will perform a visual inspection for asbestos dust/residue. If residue is found, additional wipedown/vacuuming will be performed to the satisfaction of the contracting officer. If recleaning is required, monitor the airborne fiber concentration after recleaning.

3.5.3 Monitoring After Final Cleanup

After the removal site has passed the visual inspection, provide area monitoring of fibers (at least 5 samples per removal site) under aggressive conditions. Collect and analyze the samples to establish airborne asbestos fiber concentration within the area after final cleanup but before removal of the enclosure of the regulated area. The fiber counts from the samples will be less than 0.01 fibers (longer than 5 micrometers) per cubic centimeter of air or not be greater than the levels referenced as background before the work was initiated, whichever is less. Should any of the final sampling indicate a higher value, the contractor will take appropriate actions to reclean the area and will repeat the monitoring.

3.5.4 Sampling

Sampling under aggressive conditions will include the following procedures:

a. Before starting the sampling pumps, direct the exhaust from forced air equipment (such as a l horsepower leaf blower) against all walls, ceiling, floors, ledges and other surfaces in the room. This should take at least 5 minutes per 1000 sq. ft. of floor.

b. Place a 20-inch fan in the center of the room. (Use one fan per 10,000 cubic feet of room space.) Place the fan on low speed and point it toward the ceiling.

c. Start the sampling pumps and sample for the required time.

d. Turn off the pump and then the fan(s) when sampling is complete.

3.5.5 Air Clearance Failure

Should clearance sampling results fail to meet the final cleanup requirements, the contractor will take appropriate action at no additional cost to the Government, to reclean, resample, and analyze data until final cleanup requirements are met.

3.5.6 Site Inspection

While performing asbestos removal work, the contractor will be subject to onsite inspection by the contracting officer who may be assisted by safety or health personnel. If the work is in violation of specification requirements, the contracting officer will issue a stop work order to be in effect immediately and until the violation is resolved. Standby time and expenses required to resolve the violation will be at the contractor's expense.

3.5.7 Sealing Permanent Exposed Surfaces (RACM)

After the asbestos material has been removed and HEPA vacuumed to the greatest extent possible, all permanent asbestos exposed interior surfaces will be coated with an approved lockdown sealant to permanently bind any remaining fibers in place. Sealant will be applied by airless sprayers and in accordance with the sealant manufacturers recommendations.

3.5.8 Sealant Tint

The sealant will have an adequate tint to easily distinguish between sections sealed and sections not sealed.

3.5.9 Reestablishment of the Work Area

Reestablishment of the work area will occur only after the completion of the following to the contracting officers satisfaction: performance of clean-up procedures and the successful achievement/ documentation of clearance air monitoring values.

3.5.10 Visual Inspection

The contractor and contracting officer will visually inspect the work area for any remaining visible residue. Evidence of asbestos materials will necessitate additional cleaning requirements.

3.5.11 Clearance of Work Area

Following satisfactory clearance of the work area, remaining barriers may be removed and disposed of as asbestos contaminated waste.

3.5.12 Remaining Building Demolition Procedures

Contractor may proceed with remaining building demolition procedures as described in SECTION 02050: DEMOLITION.

ASBESTOS WASTE SHIPMENT RECORD

NOTIFICATION OF ASBESTOS DEMOLITION OR RENOVATION FORM

WOODLAWN ROAD LANDFILL ASBESTOS POLICY

SECTION 02221

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS
03/91

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SECTION 02221

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS
03/91

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556 (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557 (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. (2,700 kN-m/cu.m.)

ASTM D 2167 (1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method

ASTM D 2216 (1992) Laboratory Determination of Water (Moisture) Content of Soil, and Rock

ASTM D 2487 (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 2922 (1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 2937 (1994) Density of Soil in Place by the Drive-Cylinder Method

ASTM D 3017 (1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

ASTM D 4318 (1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

1.2.1 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 methods A, B, C and D abbreviated hereinafter as percent laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Field Density Tests; FIO.

Testing of Backfill Materials; FIO.

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials include materials classified in ASTM D 2487 as GW, GP, SW, SP, SM, SC, ML, CL, MH, and CH and shall be free of trash, debris, roots or other organic matter, or stones larger than 75 mm in any dimension.

2.1.2 Unsatisfactory Materials

Unsatisfactory materials include materials classified in ASTM D 2487 as Pt, OH, OL, and any other materials not defined as satisfactory.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

2.1.4 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than four (4) when tested in accordance with ASTM D 4318.

2.1.5 Nonfrost Susceptible (NFS) Material

Nonfrost susceptible material shall be a uniformly graded washed sand with a maximum particle size of 25mm and less than 5 percent passing the 0.075 mm size sieve, and with not more than 3 percent by weight finer than 0.02 mm grain size.

2.2 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 19mm and no more than 2 percent by weight shall pass the 2.36mm size sieve.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

The areas within lines 1.5m outside of each building and structure line shall be cleared and grubbed of trees, stumps, roots, brush and other vegetation, debris, existing foundations, pavements, utility lines, structures, fences, and other items that would interfere with construction operations. Stumps, logs, roots, and other organic matter shall be completely removed and the resulting depressions shall be filled with satisfactory material, placed and compacted in accordance with paragraph FILLING AND BACKFILLING. Materials removed shall be disposed of in the designated waste disposal areas.

3.2 TOPSOIL

Topsoil shall be stripped to a depth of 150mm below existing grade within the designated excavations and grading lines and deposited in storage piles for later use. Excess topsoil shall be disposed as specified for excess excavated material.

3.3 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified hereinafter, and shall include trenching for utility and foundation drainage systems to a point 1.5m beyond the building line of each building and structure, excavation for outside grease interceptors, underground fuel tanks, and all work incidental thereto. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed and replaced with satisfactory material. Payment therefore will be made in conformance with the CHANGES clause of the CONTRACT CLAUSES. Satisfactory material removed below the depths indicated without specific direction of the Contracting Officer shall be replaced at no additional cost to the Government to the indicated excavation grade with satisfactory materials, except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation. Satisfactory material shall be placed and compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.4 DRAINAGE AND DEWATERING

3.4.1 Drainage

Surface water shall be directed away from excavation and construction sites so as to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained.

3.4.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 900 mm of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least one (1) meter below the working level.

3.5 SHORING

Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.

3.6 CLASSIFICATION OF EXCAVATION

Excavation will be unclassified regardless of the nature of material encountered.

3.7 BLASTING

Blasting will not be permitted.

3.8 UTILITY AND DRAIN TRENCHES

Trenches for underground utilities systems and drain lines shall be excavated to the required alignments and depths. The bottoms of trenches shall be graded to secure the required slope and shall be tamped if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 150 mm below the bottom of the pipe, and the overdepth shall be backfilled with satisfactory material placed and compacted in conformance with paragraph FILLING AND BACKFILLING.

3.9 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained as specified in Section 02225 EARTHWORK FOR ROADWAYS, PARKING LOTS AND HARDSTANDS.

3.10 EXCAVATED MATERIALS

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required under this section or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Section 02225 EARTHWORK FOR ROADWAYS, PARKING LOTS AND HARDSTANDS.

3.11 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. Shales shall be protected from slaking or other erosion resulting from ponding or flow of water.

3.12 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials. The surface shall be scarified to a depth of 150mm before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 150 mm, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 300 mm and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to plus or minus to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. . Moisture limits will be plus or minus three (3%) percent of optimum as determined by testing. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING.

3.13 FILLING AND BACKFILLING

Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory materials shall be placed in horizontal layers not exceeding 200 mm in loose thickness, or 150 mm when hand-operated compactors are used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Moisture limits will be plus or minus three (3%) percent of optimum as determined by testing. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill

shall be brought to indicated finish grade and shall include backfill for outside grease interceptors and underground fuel tanks. Backfill shall not be placed in wet or frozen areas. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 600 mm above sewer lines and 300 mm above other utility lines shall be free from stones larger than 25.4 mm in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 100 mm in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to seven (7) days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

	PERCENT LABORATORY MAXIMUM DENSITY	
FILL, EMBANKMENT, AND BACKFILL	COHESIVE MATERIAL	COHESIONLESS MATERIAL
Under structures, building slabs, steps paved areas, around footings, and in trenches.	90	95
Under sidewalks and grassed areas	90	90
Nonfrost susceptible materials		95
SUBGRADE		
Under building slabs, steps, and paved areas, top 300mm	90	95
Under sidewalks, top 150mm	90	90

Approved compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein before to the required density prior to further construction thereon. Recompaction over underground utilities and heating lines shall be by hand tamping.

3.14 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted if necessary by the procedure described in ASTM D 2922, paragraph ADJUSTING CALIBRATION CURVE. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. ASTM D 2937 shall be used only for soft, fine-grained, cohesive soils. The following number of tests, if performed at the appropriate time, shall be the minimum acceptable for each type operation.

3.14.1 In-Place Densities

3.14.1.1 In-Place Density of Subgrades

One test per 500 square meters or fraction thereof.

3.14.1.2 In-Place Density of Fills and Backfills

One test per 500 square meters or fraction thereof of each lift for fill or backfill areas compacted by other than hand or hand-operated machines. The density for each lift of fill or backfill materials for trenches, pits, building perimeters or other structures or areas less than six (6) meters in width, which are compacted with hand or hand-operated machines shall be tested as follows: One test per each area less than 250 square meters, or one test for each 30 linear meter of long narrow fills 100 meters or more in length. If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows: One check per lift for each 30 linear meters of long narrow fills, and a minimum of one (1) check per lift for other fill and backfill areas.

3.14.2 Moisture Content

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D 2216.

3.14.3 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 4000 cubic meters of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

3.15 CAPILLARY WATER BARRIER

Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.16 GRADING

Areas within 1.5 m outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

3.17 SPREADING TOPSOIL

Areas outside the building lines from which topsoil has been removed shall be topsoiled. The surface shall be free of materials that would hinder planting or maintenance operations. The subgrade shall be pulverized to a depth of 50 mm by disking or plowing for the bonding of topsoil with the subsoil. Topsoil shall then be uniformly spread, graded, and compacted to the thickness, elevations, slopes shown, and left free of surface irregularities. Topsoil shall be compacted by one pass of a cultipacker, roller, or other approved equipment weighing 1.46 kN/m to 2.34 kN/m of roller. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

3.18 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work shall be repaired and grades reestablished to the required elevations and slopes.

--End of Section--

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TITLE AND LOCATION DISCOM PROJECT - PHASE I/IIA, FORT CAMPBELL, KENTUCKY				CONTRACTOR										SPEC. SECTION 02221
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. SD-09 Reports										
		1	Field Density Tests; FIO.										
		2	Testing of Backfill Materials; FIO.										
			PART 2 PRODUCTS										

SECTION 02225

EARTHWORK FOR ROADWAYS, PARKING LOTS AND HARDSTANDS
12/94

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End of Section 02225-7

SAFETY PAYS

SECTION 02225
EARTHWORK FOR ROADWAYS, PARKING LOTS AND HARDSTANDS
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556 (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 2167 (1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method

ASTM D 2937 (1994) Density of Soil in Place by the Drive-Cylinder Method

ASTM D 3017 (1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.2 SUBMITTALS

Government approval is required for submittals with a “GA” designation; submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Plan Grade Spreadsheet; GA.

Contractor furnished spreadsheet shall provide all information required to determine conformance with grade requirements. The submittal must contain sufficient information in the format presented to determine if the spreadsheet will be acceptable. The spreadsheet should be adaptable to changing elevations as the project progreses through the subgrade up through and including the final surfacing. The tolerances should be readily identifiable and any nonconforming areas highlighted.

SD-08 Statements

Earthwork; GA.

Procedure and location for disposal of unused satisfactory material. Proposed source of borrow material.

SD-09 Reports

Testing; FIO.

Within 24 hours of conclusion of physical tests, three (3) copies of test results, including calibration curves and results of calibration tests.

SD-13 Certificates

Testing; GA.

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

SD-18 Records

Earthwork; FIO.

Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

1.3 SUBSURFACE DATA

Subsurface soil boring logs are appended to the DRAWINGS. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.4 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.5 BLASTING

Blasting will not be permitted.

1.6 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in designated waste disposal or spoil areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed. Newly designated waste areas on Government-controlled land shall be cleared and grubbed before disposal of waste material thereon. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, topsoil shall be stripped to a depth of 150mm. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 50mm in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be removed from the site.

3.2 EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials

encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Such excavated material and the satisfactory material ordered as replacement shall be included in excavation. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in areas approved for surplus material storage or designated waste areas. Unsatisfactory excavated material shall be disposed of in designated waste or spoil areas. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.2.1 Ditches, Gutters, and Channel Changes

Excavation of ditches, gutters, and channel changes shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. Ditches and gutters shall not be excavated below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Material excavated shall be disposed of as shown or as directed, except that in no case shall material be deposited less than one (1) meter from the edge of a ditch. The Contractor shall maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.3 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas shown or from other approved sources, either private or within the limits of the project site, selected by the Contractor. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

3.4 GRADE CONTROL

All layout, staking and grade control surveying shall be under the direct supervision of a Registered Land Surveyor who shall be responsible for the entire project. All control points, as shown on the drawings and proposed for use by the Contractor, shall be verified for horizontal and vertical accuracy and any discrepancies immediately reported to the Contracting Officer. Additional horizontal and vertical control shall be established and verified during the progress of the work and tied into the existing control points. Any existing control point removed or destroyed during the progress of the work, all building layout and all utilities will be laid out and checked by the surveyor. All grade control, including horizontal location for roads and parking lots, shall be laid out and checked by the surveyor. All grade control, including horizontal location for roads and parking lots, shall be laid out and checked by the surveyor. The surveyor shall ensure that all grade tolerances stated in the specifications and shown on the drawings for embankments subgrades, subbases, base and final pavement elevations are met. The surveyor shall be responsible for producing final surveys for “As-Built” drawings for building locations and floor elevations, storm and sanitary sewer locations and elevations and all underground utilities locations.

3.5 GRADING AREAS

Where indicated, work will be divided into grading areas within which satisfactory excavated material shall be placed in embankments, fills, and required backfills. The Contractor shall not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing.

3.6 BACKFILL

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION, and Section 02720 STORM-DRAINAGE SYSTEM; and Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.7 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of embankment materials to assure adequate bond between embankment material and the prepared ground surface. Moisture limits will be plus or minus three (3%) percent of optimum as determined by testing.

3.8 EMBANKMENTS

3.8.1 Earth Embankments

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 75mm. The material shall be placed in successive horizontal layers of loose material not more than 200mm in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary and scarified or otherwise broken up in such a manner that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Moisture limits will be plus or minus three (3%) percent of optimum as determined by testing. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.9 SUBGRADE PREPARATION

3.9.1 Construction

Subgrade shall be shaped and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Moisture limits will be plus or minus three (3%) percent of optimum as determined by testing. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 150 mm below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the subgrade for roadways shall not show deviations greater than 13mm when tested with a three (3) m straightedge applied both parallel and at right angles to the centerline of the area. The elevation of the finish subgrade shall not vary more than 15mm from the established grade and cross section.

3.9.2 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and building footprints, each layer of the embankment shall be compacted to at least 85 percent of laboratory maximum density for cohesive soils and 90 percent of maximum for cohesionless soils.

3.9.2.1 Not Used

3.9.2.2 Subgrade for Pavements

Subgrade for pavements shall be compacted to at least 90 percentage laboratory maximum density for cohesive soils and 95 percent for cohesionless for the depth below the surface of the pavement shown.

3.9.2.3 Subgrade for Shoulders

Subgrade for shoulders shall be compacted to at least 85 percentage laboratory maximum density for cohesive for the full depth of the shoulder.

3.10 SHOULDER CONSTRUCTION

Shoulders shall be constructed of satisfactory excavated or borrow material or as otherwise shown or specified. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission of the Contracting Officer has been obtained. The entire shoulder area shall be compacted to at least the percentage of maximum density as specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

3.11 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 30mm of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the

application of turfing materials.

3.12 PLACING TOPSOIL

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 50mm depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a thickness of 50mm and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from offsite areas.

3.13 TESTING

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. The first inspection be at the expense of the Government. Cost incurred for any subsequent inspections required because of failure of the first inspection will be charged to the Contractor. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. ASTM D 2937, the Drive Cylinder Method shall be used only for soft, fine-grained, cohesive soils. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification requirements. Tests on recompacted areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.13.1 Fill and Backfill Material Gradation

One test per 300 cubic meters yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C 422.

3.13.2 In-Place Densities

a. One test per 500 square meters, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

b. One test per 250 square meters, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

c. One test per 30 linear meters, feet, or fraction thereof, of each lift of embankment or backfill for roads.

3.13.3 Check Tests on In-Place Densities

If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows:

a. One check test per lift for each 3000 square meters, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.

b. One check test per lift for each 500 square meters, of fill or backfill areas compacted by hand-operated

machines.

c. One check test per lift for each 30 linear meters, or fraction thereof, of embankment or backfill for roads.

3.13.4 Moisture Contents

In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

3.13.5 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 300 cubic meters of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.13.6 Tolerance Tests for Subgrades

Continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made during construction of the subgrades.

3.14 SUBGRADE AND EMBANKMENT PROTECTION

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, or pavement, be placed on a muddy, spongy, or frozen subgrade.

-- End of Section --

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ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. SD-01 Data										
		1	Plan Grade Spreadsheet; GA.										
			SD-08 Statements										
		2	Earthwork; GA.										
			SD-09 Reports										
		3	Testing; FIO.										
			SD-13 Certificates										
		4	Testing; GA.										
			Qualifications of the commercial testing laboratory or Contractor's testing facilities.										
			SD-18 Records										
		5	Earthwork; FIO.										

SAFETY PAYS

SAFETY PAYS

SECTION 02230

CLEARING AND GRUBBING
06/97

PART 1 GENERAL 02230-1
1.1 DEFINITIONS 02230-1

PART 2 PRODUCTS (NOT APPLICABLE) 02230-1

PART 3 EXECUTION 02230-2
3.1 CLEARING 02230-1
3.2 GRUBBING 02230-1
3.3 TREE REMOVAL 02230-1
3.4 DISPOSAL OF MATERIALS 02230-2

End of Section 02230-2

SAFETY PAYS

SECTION 02230

CLEARING AND GRUBBING
06/97

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Clearing

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared.

1.1.2 Grubbing

Grubbing shall consist of the removal and disposal of stumps, roots larger than 75mm in diameter, and matted roots from the designated grubbing areas.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 CLEARING

Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work.

3.2 GRUBBING

Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 455mm below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.4 DISPOSAL OF MATERIALS

3.4.1 Not Used

3.4.2 Materials Other Than Salable Timber

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, shall be disposed of in the designated waste disposal area described in Section 02050 DEMOLITION, except when otherwise directed in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

--End of Section--

SAFETY PAYS

SECTION 02316

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS
11/97

PART 1 GENERAL 02316-1
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1.2 DEFINITIONS 02316-1
1.3 SUBMITTALS 02316-1

PART 2 PRODUCTS 02316-2
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PART 3 EXECUTION 02316-3
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SAFETY PAYS

SECTION 02316

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS
11/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422 (1963; R 1990) Particle-Size Analysis of Soils

ASTM D 1556 (1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557 (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))

ASTM D 2167 (1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method

ASTM D 2487 (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 2922 (1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 3017 (1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

KENTUCKY DEPARTMENT OF HIGHWAYS

KDOH (1998) Standard Specifications for Road and Bridge Construction

1.2 DEFINITIONS

1.2.1 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, Methods A, B, C and D.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Field Density Tests; FIO.

Testing of Backfill Materials; FIO.

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials shall consist of any material classified by ASTM D 2487 as SP, SM, SC, ML, CL, MH, CH, GW, GP, and SW.

2.1.2 Unsatisfactory Materials

Unsatisfactory materials shall be materials that do not comply with the requirements for satisfactory materials. Unsatisfactory materials include, but are not limited to, those materials containing roots and other organic matter, trash, debris, frozen materials and stones larger than 25mm, and materials classified in ASTM D 2487, as PT, OH, and OL. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials shall include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials shall include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM shall be identified as cohesionless only when the fines are nonplastic.

2.1.4 Not Used

2.1.5 Unyielding Material

Unyielding material shall consist of rock and gravely soils with stones greater than 75mm in any dimension or as defined by the pipe manufacturer, whichever is smaller.

2.1.6 Unstable Material

Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

2.1.7 Select Granular Material

Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall conform to KDOH # 8 or 9-M aggregate gradation.

2.1.8 Initial Backfill Material

Initial backfill shall consist of select granular material.

2.1.9 Plastic Marking Tape

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 152 mm wide with minimum thickness of 0.102 mm. Tape shall have a minimum strength of 12.1 MPa lengthwise and 10.3 MPa crosswise. The tape shall

be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to one (1) meter deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1. TAPE COLOR

Red	Electric
Yellow	Gas, Oil, Dangerous Material
Orange	Telephone, Telegraph, Television, Police and Fire Communications
Blue	Water Systems
Green	Sewer Systems

PART 3 EXECUTION

3.1 EXCAVATION

Excavation shall be performed to the lines and grades indicated. Rock excavation shall include removal and disposition of material defined as rock in paragraph MATERIALS. Earth excavation shall include removal and disposal of material not classified as rock excavation. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to ½ the depth of the excavation, but in no instance closer than 600 mm. Excavated material not required or not satisfactory for backfill shall be removed from the site. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Government.

3.1.1 Trench Excavation

The trench shall be excavated as shown in the drawings. Trench walls shall be made vertical. Trench walls more than 1.5 meters high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 600 mm plus pipe outside diameter (O.D.). Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

3.1.1.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 25mm or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.1.1.2 Removal of Unyielding Material

Where overdepth is not indicated and unyielding material is encountered in the bottom of the trench, such material shall be removed 100mm below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.1.1.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

3.1.1.4 Excavation for Appurtenances

Excavation for manholes, catch-basins, inlets, or similar structures shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Loose disintegrated rock and thin strata shall be removed. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.1.1.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.1.2 Stockpiles

Stockpiles of satisfactory, unsatisfactory, and wasted materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government.

3.2 BACKFILLING AND COMPACTION

Backfill material shall consist of satisfactory material, select granular material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 150 mm loose thickness for compaction by hand operated machine compactors, and 200 mm loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

3.2.1 Trench Backfill

Trenches shall be backfilled to the grade shown. The trench shall be backfilled to one (1) meters feet above the top of pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test.

3.2.1.1 Replacement of Unyielding Material

Unyielding material removed from the bottom of the trench shall be replaced with select granular material or initial backfill material.

3.2.1.2 Replacement of Unstable Material

Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm loose thickness.

3.2.1.3 Bedding and Initial Backfill

Bedding shall be select granular material as identified previously and of the thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least 600mm or as shown above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

3.2.1.4 Final Backfill

The remainder of the trench, except for special materials for roadways, railroads and airfields, shall be filled with satisfactory material. Backfill material shall be placed and compacted as follows:

a. Roadways, Railroads, and Airfields: Backfill shall be placed up to the elevation at which the requirements in Section 02225 EARTHWORK FOR ROADWAYS, PARKING LOTS, AND HARDSTANDS control. Water flooding or jetting methods of compaction will not be permitted.

b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Backfill shall be deposited in layers of a maximum of 300 mm loose thickness, and compacted to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.

3.2.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for seven (7) days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.3 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.3.1 Gas Distribution

Trenches shall be excavated to a depth that will provide not less than 450 mm of cover in rock excavation and not less than 600 mm of cover in other excavation. Trenches shall be graded as specified for pipe-laying requirements in Section 02685 GAS DISTRIBUTION SYSTEM.

3.3.2 Water Lines

Trenches shall be of a depth to provide a minimum cover of 1.2 meters from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. For fire protection yard mains or piping, an additional 150mm of cover is required.

3.3.3 Heat Distribution System

Initial backfill material shall be free of stones larger than 6.3 mm in any dimension.

3.3.4 Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 600 mm from the finished grade, unless otherwise indicated. Special trenching requirements for direct-burial electrical cables and conduits are specified in Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

3.3.5 Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 450mm below finished grade unless otherwise shown.

3.4 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

3.4.1 Testing Facilities

Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Contracting Officer. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the first inspection will be charged to the Contractor.

3.4.2 Testing of Backfill Materials

Characteristics of backfill materials shall be determined in accordance with particle size analysis of soils ASTM D 422 and moisture-density relations of soils ASTM D 1557. A minimum of one particle size analysis and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

3.4.3 Field Density Tests

Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one field density test per lift of backfill for every 30 meters of installation shall be performed. One moisture density relationship shall be determined for every 1500 cubic meters 1500 cubic yards of material used. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using the sand cone method as described in paragraph Calibration of the ASTM publication. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, at intervals as directed by the Contracting Officer. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be

furnished to the Contracting Officer. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government.

3.4.4 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to the finished grade surface, the pipe, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 900 mm shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgment of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

--End of Section--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION DISCOM PROJECT - PHASE I/IIA, FORT CAMPBELL, KENTUCKY				CONTRACTOR										SPEC. SECTION 02316
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO.										
			SD-09 Reports										
		1	Field Density Tests; FIO.										
		2	Testing of Backfill Materials; FIO.										

SAFETY PAYS

SECTION 02511

CONCRETE SIDEWALKS AND CURBS AND GUTTERS
01/89

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SAFETY PAYS

SECTION 02511

CONCRETE SIDEWALKS AND CURBS AND GUTTERS
01/89

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182 (1991) Burlap Cloth Made from Jute or Kenaf

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185 (1990a) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

ASTM A 615 (1990) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM A 616 (1990) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM A 617 (1990) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM C 31 (1991) Making and Curing Concrete Test Specimens in the Field

ASTM C 143 (1990a) Slump of Hydraulic Cement Concrete

ASTM C 171 (1991) Sheet Materials for Curing Concrete

ASTM C 172 (1990) Sampling Freshly Mixed Concrete

ASTM C 173 (1978) Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C 231 (1991b) Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C 309 (1991) Liquid Membrane-Forming Compounds for Curing Concrete

ASTM D 1751 (1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D 1752 (1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

ASTM D 3405 (1994) Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements

CORPS OF ENGINEERS (COE)

COE CRD-C 527 (1988) Standard Specification for Joint Sealants, Cold-Applied, Non-Jet-Fuel-Resistant, for Rigid and Flexible Pavements

KENTUCKY DEPARTMENT OF HIGHWAYS (KDOH)

KDOH (1998) Standard Specifications for Road and Bridge Construction

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Field Quality Control; FIO.

Copies of all test reports within 24 hours of completion of the test.

SD-18 Records

Concrete; FIO.

Copies of certified delivery tickets for all concrete used in the construction.

1.3 WEATHER LIMITATIONS

1.3.1 Placing During Cold Weather

Concrete placement shall be discontinued when the air temperature reaches 5°C and is falling. Placement may begin when the air temperature reaches 2°C and is rising. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 2°C, placement shall be approved in writing. Approval shall be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 10 and 30°C. Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 10°C for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.3.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 30°C except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 35°C.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

1.4.2 Slip Form Equipment

Slip form paver or curb forming machine, will be approved based on trial use on the job and shall be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in one pass.

PART 2 PRODUCTS

2.1 CONCRETE

Concrete shall conform to the applicable requirements of KDOH Section 601 Class A except as otherwise specified. Concrete shall have a minimum compressive strength of 24 MPa at 28 days. Maximum size of aggregate shall be as specified for KDOH No. 57s.

2.1.1 Air Content

Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

2.1.2 Slump

The concrete slump shall be 50mm plus or minus 25mm for hand placed concrete or 25mm plus or minus 13mm for slipformed concrete, determined in accordance where determined in accordance with ASTM C 143.

2.1.3 Reinforcement Steel

Reinforcement bars shall conform to ASTM A 615, ASTM A 616, or ASTM A 617. Wire mesh reinforcement shall conform to ASTM A 185.

2.2 CONCRETE CURING MATERIALS

2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

2.2.2 Burlap

Burlap shall conform to AASHTO M 182.

2.2.3 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

2.3 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.4 JOINT FILLER STRIPS

2.4.1 Contraction Joint Filler for Curb and Gutter

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.

2.4.2 Expansion Joint Filler, Premolded

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 9.5 mm (3/8 inch) 3/8 inch thick, unless otherwise indicated.

2.5 JOINT SEALANTS

2.5.1 Joint Sealant, Cold-Applied

Joint sealant, cold-applied shall conform to COE CRD-C 527.

2.5.2 Joint Sealant, Hot-Poured

Joint sealant, hot-poured shall conform to ASTM D 3405.

2.6 FORM WORK

Form work shall be designed and constructed to insure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 50mm nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 3m. Radius bends may be formed with 19mm boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 3m with a minimum of two welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

2.6.2 Curb and Gutter Forms

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 3 m or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 38mm benders, for the full height of the curb, cleated together.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted to conform with applicable requirements of Section 02225 EARTHWORK FOR ROADWAYS, PARKING LOTS AND HARDSTANDS.

3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

3.1.2 Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.

3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected so as to produce a subgrade free from frost when the concrete is deposited.

3.2 FORM SETTING

Forms shall be carefully set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of three stakes per form placed at intervals not to exceed 1.2 meters. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to insure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 3 mm in any 3m section. After forms are set, grade and alignment shall be checked with a 3.05 m (10-foot) 10-foot

straightedge. Forms shall have a transverse slope of 20mm per meter with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

3.2.2 Curbs and Gutters

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer of such thickness that when consolidated and finished the sidewalks will be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a wood float, bull float, or darby, edged and broom finished.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic.

3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished carefully with an edger having a radius of 3 mm. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 7.9mm from the testing edge of a 3.05 m straightedge. Permissible deficiency in section thickness will be up to 6.4 mm.

3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

3.4.1 Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators.

3.4.2 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The

edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 13 mm. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

3.4.3 Joint Finishing

Curb edges at formed joints shall be finished as indicated.

3.4.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 6.4mm from the testing edge of a 3.05m straightedge. Permissible deficiency in section thickness will be up to 6.4mm.

3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 1.5m on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 3m or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.

3.5.1 Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 3mm blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

3.5.2 Expansion Joints

Expansion joints shall be formed with 9.5mm joint filler strips. Joint filler shall be placed with top edge 6 mm 1/4 inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 3mm, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be carefully cleaned and filled with joint sealer.

The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing shall be done so that the material will not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 10°C at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.]

3.5.3 Reinforcement Steel Placement

Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

3.6.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 1.5m nor greater than 4.5m in length. Contraction joints shall be constructed by means of 3mm thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

3.6.2 Expansion Joints

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 9.5mm in width shall be provided at intervals not exceeding 15 meters. Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit.

Expansion joints and the top 1-inch depth of curb and gutter contraction-joints shall be sealed with joint sealer. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing shall be done so that the material will not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 10°C at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.7 CURING AND PROTECTION

3.7.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least seven (7) days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.7.1.1 Mat Method

The entire exposed surface shall be covered with two or more layers of burlap. Mats shall overlap each other at least 150 mm. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than seven (7) days.

3.7.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 300mm when a continuous sheet is not used. The curing medium shall not be less than 450mm wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than seven (7) days.

3.7.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately five (5) square meters per liter for both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within three (3) hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.7.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.7.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

SAFETY PAYS

3.8 FIELD QUALITY CONTROL

3.8.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

3.8.2 Concrete Testing

3.8.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 190 cubic meters 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31 by an approved testing laboratory. Each strength test result shall be the average of two test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 4 MPa.

3.8.2.2 Air Content

Air content shall be determined in accordance with ASTM C 173 or ASTM C 231. ASTM C 231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

3.8.2.3 Slump Test

Two slump tests shall be made on randomly selected batches of each class of concrete for every 190 cubic meters, or fraction thereof, of concrete placed during each shift. Additional tests will be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noticed along the edges of slip-formed concrete.

3.8.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.

3.8.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and

form or tool marks.

3.9 SURFACE DEFICIENCIES AND CORRECTIONS

3.9.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 6 mm 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

3.9.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 6mm. All pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

3.9.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

--End of Section--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION DISCOM PROJECT - PHASE I/IIA, FORT CAMPBELL, KENTUCKY				CONTRACTOR										SPEC. SECTION 02511
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-09 Reports										
		1	Field Quality Control; FIO.										
			SD-18 Records										
		2	Concrete; FIO.										

***** SAFETY PAYS *****

SECTION 02530

PLAYING SURFACES FOR OUTDOOR SPORTS FACILITIES
04/89

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--End of Section-- 02530-5

SECTION 02530

PLAYING SURFACES FOR OUTDOOR SPORTS FACILITIES
04/89

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33 (1993) Concrete Aggregates

ASTM C 127 (1988; R 1993) Specific Gravity and Absorption of Coarse Aggregate

ASTM C 128 (1993) Specific Gravity and Absorption of Fine Aggregate

ASTM C 131 (1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C 150 (1996) Portland Cement

ASTM C 595 (1995a) Blended Hydraulic Cements

ASTM D 1557 (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/cu.m)

ASTM D 448 (1986; R 1993) Sizes of Aggregate for Road and Bridge Construction

ASTM D 2487 (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

KENTUCKY DEPARTMENT OF HIGHWAYS (KDOH)

KDOH (1998) Standard Specifications for Road and Bridge Construction

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-3067 (Rev F) Paint: Alkyd, Exterior, Low VOC

FEDERAL SPECIFICATIONS (FS)

FS TT-W-572 (Rev B; Am 2) Fungicide: Pentachlorophenol

1.2 SUBMITTALS

SD-09 Reports

Bituminous Pavement; FIO.

1.3 EQUIPMENT, PLANT, AND TOOLS

1.3.1 General Requirements

Equipment, plant, and tools used in the work shall be subject to approval and shall be maintained in satisfactory working condition at all times. The equipment shall have the capability of producing the results specified. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with the specifications.

1.3.2 Straightedges

The Contractor shall furnish and maintain at the site, in good condition, a minimum of 2m straightedges for use in the testing of the finished surface. A straightedge shall be made available for government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom, reinforced to ensure rigidity and accuracy. Straightedges shall have handles to facilitate movement on the finished surface.

1.4 WEATHER LIMITATIONS

Construction shall occur only in dry weather with the temperature 40°F or higher. Any areas that are damaged by freezing temperatures, rainfall, or other weather conditions during any phase of the construction shall be removed and replaced in conformance with this specification without additional cost to the Government. Specialized surfaces shall meet the weather requirements as specified by the manufacturer. Where other sections are specified, those requirements shall take precedence.

1.5 DRAINAGE

Drainage shall consist of subdrains and a drainage filter course.

1.5.1 Surface Drains

Ditches and gutters shall be cut or graded to within plus or minus 5mm of cross sections and grades shown. Culverts and surface inlets to storm drains shall conform to Section 02720 STORM-DRAINAGE SYSTEM. The gratings of any existing surface inlets shall be raised or lowered to conform to the proposed finished grades.

1.5.2 Subdrains

The piping, trenching, bedding, excavating, backfilling, jointing, and installation of subdrains shall be in conformance with Section 02620 SUBDRAINAGE SYSTEM.

1.6 PROVISION FOR SPECIAL ATHLETIC FIXTURES

During the process of establishing the subgrade and prior to the placement of topsoil or surfacing or playing areas, suitable provisions shall be made for the installation of all fixed or removable appurtenances and special athletic fixtures.

PART 2 PRODUCTS

2.1 DRAINAGE FILTER

Where a drainage filter course is required, a free-draining material, meeting the gradation requirements of KDOH # 57s and # 9s, shall be selected and approved for this purpose. Material retained on the 4.75mm sieve shall have a percentage loss not to exceed 50 after 500 revolutions, as determined in accordance with ASTM C 131.

2.2 NOT USED

2.3 AGGREGATE SUB-BASE COURSE

Aggregate base course shall meet the requirements of Section KDOH DGA.

2.4 NOT USED

2.5 ASPHALTIC CONCRETE

Asphaltic concrete playing surfaces shall have a surface course that conforms to KDOH Section 403 Class I Surface.

2.5.1 Plant Requirements

Mixing-plant requirements of Section 02551 BITUMINOUS PAVING FOR ROADS, STREETS AND OPEN STORAGE AREAS will be waived where satisfactory data are submitted verifying that the plant proposed by the Contractor will produce asphaltic concrete mixtures that will meet the requirements of the applicable section of these specifications.

2.6 NOT USED

2.6.1 Aggregate

2.7 COLORING AND PAINT

The entire surface of asphalt playing surfaces shall be coated with a color coat, applied according to manufacturer's recommendations. Playing lines shall be marked with marking paint having the same characteristics and performance as the color coating except that the paint shall be suitable for application by spray equipment. Coloring and paint shall conform to the applicable requirements of Section 09900 PAINTING, GENERAL.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

Clearing and grubbing, where required, shall conform to Section 02230 CLEARING AND GRUBBING.

3.2 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES

Excavation, trenching, and backfilling for utilities, where required, shall conform to Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.3 EXCAVATION AND BACKFILLING FOR FIXTURES

Excavation and backfilling for fixtures shall incorporate, where required, soil poisoning as specified in Section 02221 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS.

3.4 GRADING

Grading shall conform to Section 02225 EARTHWORK FOR ROADWAYS, PARKING LOTS AND HARDSTANDS and Section 02935 TURF, modified as follows: Fills required to bring the subgrade of playing surfaces up to required elevation shall be placed in horizontal layers of not more than 200mm in loose thickness. Each layer shall be compacted to at least 90 percent of ASTM D 1557 maximum density. The top layer of all fills and excavated areas under the playing surfaces shall be compacted to 95 percent ASTM D 1557 maximum density for cohesionless soils and 90 percent for cohesive soils.

3.5 DRAINAGE FILTER COURSE

The drainage filter course material shall be placed and compacted on the prepared subgrade to form uniform layers not less than 100mm nor more than 150mm thick. Each layer of filter material shall be saturated by flooding and thoroughly compacted prior to receiving any overlying fill, course, topsoil, or surfacing.

3.6 TURF SURFACES

Natural turf shall be established and maintained in accordance with Section 02935 TURF.

3.7 AGGREGATE SUB-BASE COURSE

A layer 150mm thick of KDOH DGA shall be spread over the subgrade and shall be compacted by rolling. The stone subbase course shall be compacted to a minimum of 95 percent of ASTM D 1557 maximum density. (Density testing shall be performed at one (1) test per 100 sq meters per lift.)

3.8 NOT USED

3.9 NOT USED

3.10 BITUMINOUS SURFACES

3.10.1 Base Course

The stabilized aggregate base course shall be compacted as specified in Section 02714 DRAINAGE LAYER.

3.10.2 Prime Coat

Prior to the placing of the bituminous leveling course, the completed base course shall be primed in accordance with KDOH Section 407 - ASPHALT PRIME AND TACK COATS at a rate of 1.6 liters per square meter of Primer-L.

3.10.3 Tack Coat

Prior to the placing of the surface course, a tack coat shall be applied to the completed bituminous leveling course in accordance with KDOH Section 407 - ASPHALT PRIME AND TACK COATS at a rate of 0.23 liter per square meter of undiluted material.

3.10.4 Bituminous Mixtures

Compaction of mixtures in each course shall be in accordance with applicable requirements of Section 02551 BITUMINOUS PAVING FOR ROADS, STREETS AND OPEN STORAGE AREAS except that rollers weighing 4.5 metric tons or more may be used. The bituminous mixture shall be compacted to a minimum of 93 percent density of laboratory density, as determined in the above section.

3.11 NOT USED

3.12 COLOR COATING AND MARKING PAINT

After curing of the underlying bituminous, or PCC surface course for 30 days, the entire playing surface shall be covered with a color coat, selected and spread in accordance with Section 09900 PAINTING, GENERAL.

3.13 NOT USED

3.14 NOT USED

3.15 COURT LINES AND RESTRICTION MARKINGS

Court lines and restriction markings shall be applied with the type of paint or other marking material best adapted for a weather-resistant and durable marking on the particular type of playing surface. Court lines for multiple court areas shall be applied with different colors as approved by the Contracting Officer.

3.16 NOT USED

3.17 GRADE AND SURFACE-SMOOTHNESS REQUIREMENTS

3.17.1 Grade Requirements

The finished surfaces of all asphalt playing surfaces shall conform to within 5mm of the line and grade requirements. Grade control for all surfaces shall be established and maintained by means of a string line stretched between grade pins. To maintain horizontal control of portland cement concrete playing surfaces, forms shall be used around each individual playing area to be surfaced. Forms shall be of straight wood or steel, of sufficient strength to resist springing during construction, and of a height equal to the full depth of the finished surface. Metal forms shall be of approved section with a flattop surface and a base width equal to the height of the form. Forms shall be set with the upper edge to line and grade and shall be held rigidly in place by stakes placed on the outside of forms and set flush with the top edge of the form.

3.17.2 Tests for Surface Smoothness

The finished surface of all asphalt playing surfaces shall be tested with an approved straightedge to reveal surface irregularities exceeding the tolerances specified herein. The Contractor shall furnish and maintain, at the site, one or more straightedges (in good condition) for use in testing the finished surface. The entire playing surface between perimeter forms shall be tested in both a longitudinal and a transverse direction on parallel lines 2m apart or less. The straightedge shall be in contact with the surface and shall be moved ahead one-half the length of the straightedge for each successive series of measurements. Areas of asphalt concrete playing surfaces that deviate by more than 3.2mm from the testing edge of the straightedge shall be plainly marked and corrected as described in Section 02551 BITUMINOUS PAVING FOR ROADS, STREETS AND OPEN STORAGE AREAS.
--End of Section--

SUBMITTAL REGISTER
(ER415-1-10)

CONTRACT NO.

TITLE AND LOCATION
DISCOM Barracks Complex Phase 1, Fort Campbell, KY

CONTRACTOR

SPEC. SECTION
02530

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-09 Reports										
		1	Bituminous Pavement; FIO.										

SECTION 02551

BITUMINOUS PAVING FOR ROADS, STREETS AND OPEN STORAGE AREAS
04/89

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End of Section 02551-12

SAFETY PAYS

SECTION 02551

BITUMINOUS PAVING FOR ROADS, STREETS AND OPEN STORAGE AREAS
04/89

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

KENTUCKY DEPARTMENT OF HIGHWAYS (KDOH)

KDOH (1998) Standard Specifications for Road and Bridge Construction

MILITARY STANDARDS (MIL-STD)

MIL-STD 620 (Rev A; Notice 1) Test Methods for Bituminous Paving Materials

U.S. ARMY CORPS OF ENGINEERS, WATERWAYS EXPERIMENT STATION (CEWES)

CEWES CRD-C 119 (1953; Rev. Jun 1963) Handbook for Concrete Cement, Flat and Elongated Particles in Coarse Aggregate

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Bituminous Pavement; FIO.

Copies of test results.

Mix Design; GA.

a. Submit a job mix formula, prepared within six (6) months of submittal for approval by the Contracting Officer prior to preparing and placing the bituminous mixture. Design mix using procedures contained in Chapter III, Marshall Method of Mix Design, of the Asphalt Institute MS-2. The formulas shall indicate the physical properties of the mixes as shown by tests made by an approved commercial laboratory using materials identical to those to be used on this project. Submit all formulas with materials samples. The job mix formula for each mixture shall be in effect until modified in writing by the Contracting Officer. Provide a new job mix formula for each source change.

b. The job mix formula shall show the following: the source and proportions (percent by weight) of each ingredient of the mixture; the correct gradation (the percentages passing each sieve size listed in the specifications for the mixture to be used) for the aggregate and mineral filler from each separate source and from each different size to be used in the mixture and for the composite mixture; the amount of material passing the No. 0.075mm

sieve determined by dry sieving; the number of blows of hammer compaction per side of molded specimen, the temperature viscosity relationship of the asphalt cement; the stability, flow, percent voids in mineral aggregate; effective asphalt content as percent by weight of total mix; the temperature of the mixture immediately upon completion of mixing; the asphalt viscosity grade and or penetration range; and:

THE RESULTS OF:	**AS DETERMINED BY:**
Specific Gravity of Asphalt Coarse Aggregate	ASTM D 70
Bulk Specific Gravity	ASTM C 127
Abrasion Loss	ASTM C 131
Soundness Loss	ASTM C 88
Weight of Slag	ASTM C 29
% Crushed Pieces in Gravel	CEWES CRD-C 119
Fine Aggregates:	
Bulk Specific Gravity	ASTM C 128
Soundness Loss	ASTM C 88
Mineral Filler - Specific Gravity	ASTM D 1188 or ASTM D 2726
Bituminous Mixture:	
Bulk Specific Gravity	ASTM D 1188 or ASTM D 2726
Theoretical Maximum Specific Gravity	ASTM D 2041
Index of Retained Strength	ASTM D 1075

c. Charts: Plot and submit, on a grain size chart, the specified aggregate gradation band, the job mix gradation and the job mix tolerance band.

d. Specimens: ASTM D 1559 for the making and testing of all bituminous specimens with the following exceptions:

e. Compaction: Apply 75 blows of the hammer to each flat face of the specimens.

f. Curves: Plot and submit curves for the various courses to show the effect on the test properties of at least four (4) different percentages of asphalt on the unit weight, stability, flow, air voids, and voids in mineral aggregate; each point on the curves shall represent the average of at least four (4) specimens.

g. Cooling of the Specimen: After compaction is completed, allow the specimen to cool in air the same temperature approximately as that of the water (25°C) to be used in the specific gravity determination.

h. Selection of Optimum Asphalt Content: Base selection on percent of total mix and the average of the values at the following points on the curves for each mix:

Stability	Peak
Unit Weight	Peak
Percent Air Voids	Medium

SD-14 Samples

Bituminous Pavement; GA.

Samples of the materials in the quantities indicated below for the job mix formula.

Aggregate and mineral filler (if needed) to be blended in approximately the same proportions as used in the project	100 kg

Mineral Filler	10 kg
Anti-striping agent, when used Asphalt Cement	20 liters

1.3 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.3.1 General

The bituminous plant shall be of such capacity to produce the quantities of bituminous mixtures required. Hauling equipment, paving machines, rollers, miscellaneous equipment, and tools shall be provided in sufficient numbers and capacity and in proper working condition to place the bituminous paving mixtures at a rate equal to the plant output.

1.3.2 Mixing Plants

The mixing plant shall be an automatic or semiautomatic controlled commercially manufactured unit designed and operated to consistently produce a mixture within the job-mix formula (JMF). The plant shall have a minimum capacity of 150 metric tons per hour. Drum mixers shall be prequalified at the production rate to be used during actual mix production. The prequalification tests will include extraction and recovery of the asphalt cement in accordance with ASTM D 2172 and ASTM D 1856. The penetration of the recovered asphalt binder shall not be less than 60 percent of the original penetration, as measured in accordance with ASTM D 5.

1.3.3 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 3.66m straightedge for each bituminous paver. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.4 WEATHER LIMITATIONS

Unless otherwise directed, bituminous courses shall not be constructed when temperature of the surface of the existing pavement or base course is below 5°C.

1.5 PROTECTION OF PAVEMENT

After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until the pavement has cooled to 60°C.

1.6 GRADE AND SURFACE-SMOOTHNESS REQUIREMENTS

Finished surface of bituminous courses, when tested as specified below and in paragraph ACCEPTABILITY OF WORK, shall conform to gradeline and elevations shown and to surface-smoothness requirements specified.

1.6.1 Plan Grade

The grade of the completed surface shall not deviate more than 15.2 mm (0.05 foot) 0.05 foot from the plan grade.

1.6.2 Surface Smoothness

When a 3.66m straightedge is laid on the surface parallel with the centerline of the paved area or transverse from crown to pavement edge, the surface shall vary not more than 6.4mm from the straightedge.

1.7 GRADE CONTROL

Lines and grades shall be established and maintained by means of line and grade stakes placed at site of work in accordance with the Special Contract Requirements. Elevations of bench marks used by the Contractor for controlling pavement operations at the site of work will be determined, established, and maintained by the Government. Finished pavement elevations shall be established and controlled at the site of work by the Contractor in accordance with bench mark elevations furnished by the Contracting Officer.

1.8 SAMPLING AND TESTING

1.8.1 Aggregates

1.8.1.1 General

Samples of aggregates shall be furnished by the Contractor for approval of aggregate sources and stockpiles prior to the start of production and at times during production of the bituminous mixtures. Times and points of sampling will be designated by the Contracting Officer. Samples will be the basis of approval of specific sources or stockpiles of aggregates for aggregate requirements. Unless otherwise directed, ASTM D 75 shall be used in sampling coarse and fine aggregate, and ASTM C 183 shall be used in sampling mineral filler. All tests necessary to determine compliance with requirements specified herein will be made by the Government.

1.8.1.2 Sources

Sources of aggregates shall be selected well in advance of the time the materials are required in the work. If a previously developed source is selected, evidence shall be submitted 90 days before starting production, indicating that the central-plant hot-mix bituminous pavements constructed with the aggregates have had a satisfactory service record of at least five years under similar climatic and traffic conditions. The Contracting Officer will make such tests and other investigations as necessary to determine whether aggregates meeting requirements specified herein can be produced from proposed sources. If a sample of material from a new source fails to meet specification requirements, the material represented by the sample shall be replaced, and the cost of testing the replaced sample will be at the expense of the Contractor. Approval of the source of aggregate does not relieve the Contractor of responsibility for delivery at the jobsite of aggregates that meet the requirements specified herein.

1.8.2 Bituminous Materials

Samples of bituminous materials shall be obtained by the Contractor; sampling shall be in accordance with ASTM D 140. Tests necessary to determine conformance with requirements specified herein will be performed by the Contractor without cost to the Government. Sources where bituminous materials are obtained shall be selected in advance of the time when materials will be required in the work. In addition to initial qualification testing of bituminous materials, samples shall be taken before and during construction when shipments of bituminous materials are received or when necessary to assure some condition of handling or storage has not been detrimental to the bituminous material. The samples will be taken by the Contractor and tested by the Contractor.

1.8.3 Bituminous Mixtures

Sampling and testing of bituminous mixtures will be accomplished by the Contractor.

1.9 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

1.9.1 Mineral Aggregates

Mineral aggregates shall be delivered to the site of the bituminous mixing plant and stockpiled in such manner as to preclude fracturing of aggregate particles, segregation, contamination, or intermingling of different materials in

the stockpiles or cold-feed hoppers. Mineral filler shall be delivered, stored, and introduced into the mixing plant in a manner to preclude exposure to moisture or other detrimental conditions.

1.9.2 Bituminous Materials

Bituminous materials shall be maintained at appropriate temperature during storage but shall not be heated by application of direct flame to walls of storage tanks or transfer lines. Storage tanks, transfer lines, and weigh buckets shall be thoroughly cleaned before a different type or grade of bitumen is introduced into the system. The asphalt cement shall be heated sufficiently to allow satisfactory pumping of the material; however, the storage temperature shall be maintained below 150°C.

1.10 ACCESS TO PLANT AND EQUIPMENT

The Contracting Officer shall have access at all times to all parts of the paving plant for checking adequacy of the equipment in use; inspecting operation of the plant; verifying weights, proportions, and character of materials; and checking temperatures maintained in preparation of the mixtures.

1.11 WAYBILLS AND DELIVERY TICKETS

Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified waybills and certified delivery tickets for all aggregates and bituminous materials actually used in construction.

PART 2 PRODUCTS

2.1 BITUMINOUS HOT MIX

Shall consist of coarse aggregate, fine aggregate, mineral filler, bituminous material, and approved additives, if required, of the qualities and in the proportions specified and shall conform to the requirements contained in paragraphs PROPORTIONING OF MIXTURE and ACCEPTABILITY OF WORK.

2.1.1 Aggregates

Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screening, sand, and mineral filler, as required. The portion of materials retained on the 4.75mm sieve shall be known as coarse aggregate, the portion passing the 4.75mm sieve and retained on the 0.075mm sieve as fine aggregate, and the portion passing the 0.075 millimeter No. 200 sieve as mineral filler. Aggregate gradation shall conform to gradation(s) specified in KDOH Section 403 PRODUCTION AND PLACEMENT OF ASPHALT MIXTURES, CLASS AK SURFACE, CLASS I BINDER and Section 804 FINE AGGREGATES and Section 805 COARSE AGGREGATE.

2.1.1.1 Coarse Aggregate

Coarse aggregate shall consist of clean, sound, durable particles meeting the following requirements.

a. Percentage of loss shall not exceed 40 after 500 revolutions, as determined in accordance with ASTM C 131.

b. Percentage of loss shall not exceed 12 percent after five cycles performed in accordance with ASTM C 88, using magnesium sulfate.

c. The dry weight of crushed slag shall not be less than 1200 kg/cubic m, 75 pcf, as determined in accordance with ASTM C 29.

d. Crushed gravel retained on the 4.75mm sieve and each coarser sieve shall contain at least 75 percent by weight of crushed pieces having one or more fractured faces with the area of each face equal to at least 75 percent of the smallest midsectional area of piece. When two fractures are contiguous, the angle between planes of fractures shall be at least 30 degrees to count as two fractured faces.

e. Particle shape of crushed aggregates shall be essentially cubical. The quantity of flat and elongated particles in any sieve size shall not exceed 20 percent by weight, when determined in accordance with ASTM D 4791.

2.1.1.2 Fine Aggregate

Fine aggregate shall consist of clean, sound, durable particles including natural sand or crushed stone, slag, or gravel that meets requirements for wear and soundness specified for coarse aggregate. Fine aggregate produced by crushing gravel shall have at least 90 percent by weight of crushed particles having two or more fractured faces in the portion retained on the 0.600mm sieve. This requirement shall apply to the material before blending with natural sand when blending is necessary. Quantity of natural sand to be added to the wearing- and intermediate-course mixtures shall not exceed 25 percent by weight of coarse and fine aggregate and material passing the 0.075mm sieve. Natural sand shall be clean and free from clay and organic matter. Percentage of loss shall not exceed 15 percent after five cycles of the soundness test performed in accordance with ASTM C 88, using magnesium sulfate.

2.1.1.3 Mineral Filler

Mineral filler shall conform to ASTM D 242.

2.1.2 Bituminous Material

Asphalt cement shall conform to Grade AC-20.

2.1.3 Additives

The use of additives such as antistripping and antifoaming agents is subject to approval.

2.2 PROPORTIONING OF MIXTURE

2.2.1 Job Mix Formula

The JMF for the bituminous mixture will be furnished by the Contractor to the Contracting Officer. The Contractor shall furnish samples of materials for mix design. Blending of the aggregates will be accomplished by the Contractor. No payment will be made for mixtures produced prior to the approval of the JMF. The formula will indicate the percentage of each stockpile and mineral filler, the percentage of each size aggregate, the percentage of bitumen, and the temperature of the completed mixture when discharged from the mixer. Tolerances are given in TABLE II for asphalt content, temperature, and aggregate grading for tests conducted on the mix as discharged from the mixing plant; however, the final evaluation of aggregate gradation and asphalt content will be based on paragraph ACCEPTABILITY OF WORK. Bituminous mix that deviates more than 14°C from the JMF shall be rejected. The JMF may be adjusted during construction to improve paving mixtures, as directed, without adjustments in the contract unit prices.

TABLE II. JOB-MIX TOLERANCES

MATERIAL	TOLERANCE, PLUS or MINUS
Aggregate passing 4.7mm sieve or larger	5 percent
Aggregate passing 2.36, 1.18, 0.6, and 0.3mm sieves	4 percent

Aggregate passing 150 and 75 micrometer sieves	2 percent
Bitumen	0.25 percent
Temperature of Mixing	14°C

2.2.2 Test Properties of Bituminous Mixtures

Finished mixture shall meet requirements described below when tested in accordance with MIL-STD 620, Method 100. All samples will be compacted with 50 blows of specified hammer on each side of sample. When bituminous mixture fails to meet the requirements specified below, the paving operation shall be stopped until the cause of noncompliance is determined and corrected.

2.2.2.1 Stability, Flow, and Voids

Requirements for stability, flow, and voids are shown in TABLES III and IV for nonabsorptive and absorptive aggregates, respectively.

TABLE III. NONABSORPTIVE-AGGREGATE MIXTURE

	WEARING COURSE	INTERMEDIATE COURSE
Stability minimum, newtons	2200	2200
Flow maximum, 25/100mm units	20	20
Voids total mix, percent (1)	3-5	4-6
Voids filled with bitumen percent (2)	75-85	65-75

TABLE III. NONABSORPTIVE-AGGREGATE MIXTURE

	WEARING COURSE	INTERMEDIATE COURSE
Stability minimum, newtons	2200	2200
Flow maximum, 25/100mm units	20	20
Voids total mix, percent (1)	3-5	4-6
Voids filled with bitumen percent (2)	80-90	70-80

(1) The Contracting Officer may permit deviations from limits specified when gyratory method of design is used to develop the JMF.

(2) The Contracting Officer may permit deviation from limits specified for voids filled with bitumen in the intermediate course in order to stay within limits for percent voids total mix.

a. When the water-absorption value of the entire blend of aggregate does not exceed 2.5 percent as determined in accordance with ASTM C 127 and ASTM C 128, the aggregate is designated as nonabsorptive. The theoretical specific gravity computed from the apparent specific gravity or ASTM D 2041 will be used in computing voids total mix and voids filled with bitumen, and the mixture shall meet requirements in TABLE III.

b. When the water-absorption value of the entire blend of aggregate exceeds 2.5 percent as determined in accordance with ASTM C 127 and ASTM C 128, the aggregate is designated as absorptive. The theoretical specific gravity computed from the bulk-impregnated specific gravity method contained in ASTM D 2041 shall be used in computing percentages of voids total mix and voids filled with bitumen; the mixture shall meet requirements in TABLE IV.

2.2.2.2 Stability

The index of retained stability must be greater than 75 percent as determined by MIL-STD 620, Method 104. When the index of retained stability is less than 75, the aggregate stripping tendencies may be countered by the use of hydrated lime or by treating the bitumen with an approved antistripping agent. The hydrated lime is considered as mineral filler and should be considered in the gradation requirements. The amount of hydrated lime or

antistripping agent added to bitumen shall be sufficient, as approved, to produce an index of retained stability of not less than 75 percent. No additional payment will be made to the Contractor for addition of antistripping agent required.

PART 3 EXECUTION

3.1 BASE COURSE CONDITIONING

The surface of the base course will be inspected for adequate compaction and surface tolerances specified in Section 02243, DRAINAGE LAYER. Unsatisfactory areas shall be corrected.

3.2 EXISTING PAVEMENT CONDITIONING

Pavement matching into existing paved areas shall be as detailed in the drawings or by milling approximately 25mm depth for the full width of the paved area, tack coating the existing pavement and resurfacing. The depth of new surface added shall be a minimum of 25mm when milling is used.

3.3 PREPARATION OF BITUMINOUS MIXTURES

Rates of feed of aggregates shall be regulated so that the moisture content and temperature of aggregates will be within specified tolerances. Aggregates, mineral filler, and bitumen shall be conveyed into the mixer in proportionate quantities required to meet the JMF. Mixing time shall be as required to obtain a uniform coating of the aggregate with the bituminous material. Temperature of bitumen at time of mixing shall not exceed 150°C. Temperature of aggregate and mineral filler in the mixer shall not exceed 160°C when bitumen is added. Overheated and carbonized mixtures or mixtures that foam shall not be used.

3.4 WATER CONTENT OF AGGREGATES

Drying operations shall reduce the water content of mixture to less than 0.75 percent. The water content test will be conducted in accordance with ASTM D 2216; the weight of the sample shall be at least 500 grams. If the water content is determined on hot bin samples, the water content will be a weighted average based on composition of blend.

3.5 STORAGE OF BITUMINOUS PAVING MIXTURE

Storage shall conform to the applicable requirements of ASTM D 3515; however, in no case shall the mixture be stored for more than four (4) hours.

3.6 TRANSPORTATION OF BITUMINOUS MIXTURE

Transportation from paving plant to site shall be in trucks having tight, clean, smooth beds lightly coated with an approved releasing agent to prevent adhesion of the mixture to the truck bodies. Excessive releasing agent shall be drained prior to loading. Each load shall be covered with canvas or other approved material of ample size to protect mixture from weather and to prevent loss of heat. Loads that have crusts of cold, unworkable material or that have become wet will be rejected. Hauling over freshly placed material will not be permitted.

3.7 SURFACE PREPARATION OF UNDERLYING COURSE

Prior to placing of the intermediate or wearing course, the underlying course shall be cleaned of all foreign or objectionable matter with power brooms and hand brooms.

3.8 NOT USED

3.9 TACK COATING

Contact surfaces of previously constructed pavement, curbs, manholes, and other structures shall be sprayed with a thin coat of bituminous material conforming to KDOH Section 407 ASPHALT PRIME AND TACK COAT.

3.10 PLACING

Bituminous courses shall be constructed only when the base course or existing pavement has no free water on the surface. Bituminous mixtures shall not be placed without ample time to complete spreading and rolling during daylight hours, unless approved satisfactory artificial lighting is provided.

3.10.1 Offsetting Joints

The wearing course shall be placed so that longitudinal joints of the wearing course will be offset from joints in the intermediate course by at least 300mm. Transverse joints in the wearing course shall be offset by at least 600mm from transverse joints in the intermediate course.

3.10.2 General Requirements for Use of Mechanical Spreader

Range of temperatures of mixtures, when dumped into the mechanical spreader, shall be as determined by the Contracting Officer. Mixtures having temperatures less than 110°C when dumped into the mechanical spreader shall not be used. The mechanical spreader shall be adjusted and the speed regulated so that the surface of the course being laid will be smooth and continuous without tears and pulls, and of such depth that, when compacted, the surface will conform to the cross section indicated. Placing with respect to center line areas with crowned sections or high side of areas with one-way slope shall be as directed. Each lot of material placed shall conform to requirements specified in paragraph ACCEPTABILITY OF WORK. Placing of the mixture shall be as nearly continuous as possible, and speed of placing shall be adjusted, as directed, to permit proper rolling. When segregation occurs in the mixture during placing, the spreading operation shall be suspended until the cause is determined and corrected.

3.10.3 Placing Strips Succeeding Initial Strips

In placing each succeeding strip after initial strip has been spread and compacted as specified below, the screed of the mechanical spreader shall overlap the previously placed strip 50 to 75mm and be sufficiently high so that compaction produces a smooth dense joint. Mixture placed on the edge of a previously placed strip by the mechanical spreader shall be pushed back to the edge of the strip by use of a lute. Excess mixture shall be removed and wasted.

3.10.4 Handspreading in Lieu of Machine Spreading

In areas where the use of machine spreading is impractical, the mixture shall be spread by hand. Spreading shall be in a manner to prevent segregation. The mixture shall be spread uniformly with hot rakes in a loose layer of thickness that, when compacted, will conform to required grade, density, and thickness.

3.11 COMPACTION OF MIXTURE

Rolling shall begin as soon after placing as the mixture will bear a roller without undue displacement. Delays in rolling freshly spread mixture will not be permitted. After initial rolling, preliminary tests of crown, grade, and smoothness shall be made by the Contractor. Deficiencies shall be corrected so that the finished course will conform to requirements for grade and smoothness specified herein. Crown, grade, and smoothness will be checked in each lot of completed pavement by the Contracting Officer for compliance and will be evaluated as

specified in paragraph ACCEPTABILITY OF WORK. After the Contractor is assured of meeting crown, grade, and smoothness requirements, rolling shall be continued until a mat density of 93.0 to 95.0 percent and a joint density of 95.0 to 100.0 percent of density of laboratory-compacted specimens of the same mixture is obtained. The density will be determined and evaluated as specified in paragraph ACCEPTABILITY OF WORK. Places inaccessible to rollers shall be thoroughly compacted with hot hand tampers.

3.11.1 Testing of Mixture

At the start of the plant operation, a quantity of mixture shall be prepared that is sufficient to construct a test section at least 45m long, two spreader widths wide and of thickness to be used in the project. Mixture shall be placed, spread, and rolled with equipment to be used in the project and in accordance with the requirements specified above. This test section shall be tested and evaluated as a lot and shall conform to all specified requirements. If test results are satisfactory, the test section shall remain in place as part of the completed pavement. If tests indicate that the pavement does not conform to specification requirements, necessary adjustments to plant operations and rolling procedures shall be made immediately, and test section will be evaluated as specified in paragraph ACCEPTABILITY OF WORK. Additional test sections, as directed, shall be constructed and sampled for conformance to specification requirements. In no case shall the Contractor start full production of an intermediate or wearing course mixture without approval.

3.11.2 Correcting Deficient Areas

Mixtures that become contaminated or are defective shall be removed to the full thickness of the course. Edges of the area to be removed shall be cut so that sides are perpendicular and parallel to the direction of traffic and so that the edges are vertical. Edges shall be sprayed with bituminous materials conforming to KDOH Section 407, BITUMINOUS PRIME AND TACK COAT. Fresh paving mixture shall be placed in the excavated areas in sufficient quantity so that the finished surface will conform to grade and smoothness requirements. Paving mixture shall be compacted to the density specified herein. Skin patching of an area that has been rolled shall not be permitted.

3.12 JOINTS

3.12.1 General

Joints between old and new pavements, between successive work days, or joints that have become cold (less than 80°C) shall be made to insure continuous bond between the old and new sections of the course. All joints shall have the same texture and smoothness as other sections of the course. Contact surfaces of previously constructed pavements coated by dust, sand, or other objectionable material shall be cleaned by brushing or shall be cut back as directed. When directed by the Contracting Officer, the surface against which new material is placed shall be sprayed with a thin, uniform coat of bituminous material conforming to KDOH Section 407, ASPHALT BITUMINOUS PRIME AND TACK COAT. Material shall be applied far enough in advance of placement of a fresh mixture to insure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

3.12.2 Transverse Joints

The roller shall pass over the unprotected end of a strip of freshly placed material only when placing is discontinued or delivery of the mixture is interrupted to the extent that the material in place may become cold. In all cases, prior to continuing placement, the edge of previously placed pavement shall be cut back to expose an even vertical surface for full thickness of the course. In continuing placement of a strip, the mechanical spreader shall be positioned on the transverse joint so that sufficient hot mixture will be spread to obtain a joint after rolling that conforms to the required density and smoothness specified herein.

3.12.3 Longitudinal Joints

Edges of a previously placed strip shall be prepared such that the pavement in and immediately adjacent to the joint between this strip and the succeeding strip meets the requirements for grade, smoothness, and density specified in paragraph ACCEPTABILITY OF WORK.

3.13 ACCEPTABILITY OF WORK

3.13.1 General

The Contractor shall be responsible for all testing. Testing shall be done by an approved commercial laboratory. The Contractor will conduct all initial acceptance tests. Additional tests required to determine acceptability of nonconforming material will be performed by the Government at the expense of the Contractor.

3.13.2 Not Used

3.13.3 Asphalt Content

For each 1000 metric tons or fraction thereof bituminous course placed the mean absolute deviation of the asphalt content from the JMF will be evaluated and compared to the table below. Asphalt content tests shall be completed and reported within 24 hours after construction of the lot. Payment will be based on the value determined in the table.

TABLE VI. PERCENT PAYMENT BASED ON ASPHALT CONTENT

Mean Absolute Deviation of Extracted Asphalt Content from JMF	Percent Payment
0.25 - 0.40	100
above 0.40	reject

3.13.4 Density

For each 1,000 metric tons of bituminous course placed, determine the representative laboratory density by averaging the density of four (4) laboratory specimens prepared in accordance with ASTM D 1559; samples for density shall be taken from trucks delivering mixture on the site; the Contractor shall record in an approved manner the project areas represented by the laboratory densities. From each representative area so recorded, determine field density of the pavement by averaging the densities of 100mm diameter cores obtained form the course placed. One core shall be taken for each 1675 square yards or fraction thereof course placed. The density of the laboratory prepared specimens and the cored samples will be determined in accordance with ASTM D 1188 or ASTM D 2726, as applicable. The field density shall meet or exceed 95 percent of the laboratory density. Pavement layers shall e separated by sawing or other approved methods. The average density of each course placed shall be not less than 95 percent of the laboratory density. When the specified density is not obtained, the Contractor may elect to take additional cores to define the limits of low densities and shall correct each area by removing the pavement in question and replace with new pavement. In replacement of the pavement in question, the removal will be continuous without skips for isolated passing areas until all remaining pavements are continuous and meet the required densities. Removals of pavement shall be for the full width of a paying lane. The Contractor shall fill all sample holes with hot mix, compact and finish.

SAFETY PAYS

3.13.5 Grade

The Contractor shall develop a “Plan-Grade” spreadsheet for all paved areas that will be used to verify conformance with the contract requirements. During the progress of the paving operations the spreadsheet will be updated and the conformance verified with the requirements as listed herein.

The finished grades of each course placed shall not vary from the finished elevations, profiles and typical sections indicated on the drawings by more than 12.5mm. The finished grade of each pavement area shall be determined by running lines of levels at intervals of 8m or less longitudinally and transversely to determine the elevation of the completed pavement. Within ten (10) days after completion of final placement, the Contractor shall perform a level survey at the specified grid spacing and furnish the results on the plan grade spreadsheet at the same grid spacing. Elevations not in conformance with the specified tolerance shall be noted on the plan grade spreadsheet in an approved manner. The survey shall be performed by a registered land surveyor. The Contractor shall correct the deficient paved areas and replace with fresh paving mixture at no additional cost to the Government. Sufficient material shall be removed to allow at least 25mm of asphalt concrete to be placed. Skin patching for correcting low areas or planing for correcting high areas shall not be permitted.

3.13.6 Surface Smoothness

After completion of final rolling of a lot, the compacted surface will be tested by the Contracting Officer with a 3.66m straightedge. Measurements will be made perpendicular to and across all mats at distances along the mat not to exceed 8 m. Location and deviation from straightedge of all measurements will be recorded. When more than 5 percent of all measurements along the mat within a lot exceed the specified tolerance, the unit price for that lot shall not exceed 95 percent of the bid price. Any joint or mat area surface deviation which exceeds the tolerance given in paragraph GRADE AND SURFACE-SMOOTHNESS REQUIREMENTS by more than 50 percent shall be corrected to meet the specification requirements. The Contractor shall remove the deficient area and replace with fresh paving mixture at no additional cost to the Government. Sufficient material shall be removed to allow at least 25mm of asphalt concrete to be placed. Skin patching for correcting low areas or planing for correcting high areas shall not be permitted.

3.13.7 Thickness

Determine thickness of the surface and binder courses from samples taken for the field density tests. The maximum allowable deficiency at any point shall not be more than 6.35mm less than the allowed for any course. The average thickness of the course or the combined courses shall be not less than the specified thickness. Where the deficiency is more than the specified tolerances, the Contractor shall correct each area by removing the pavement in question and replace with new pavement.

--End of Section--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION DISCOM PROJECT - PHASE I/IIA, FORT CAMPBELL, KENTUCKY				CONTRACTOR										SPEC. SECTION 02551
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-09 Reports										
		1	Bituminous Pavement; FIO.										
		2	Mix Design; GA.										
			SD-14 Samples										
		3	Bituminous Pavement; GA.										

SAFETY PAYS

*** SAFETY PAYS ***

SECTION 02580

PAVEMENT MARKINGS
02/91

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End of Section 02580-5

*** SAFETY PAYS ***

SECTION 02580

PAVEMENT MARKINGS
02/91

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 247 (1981; Rev 1986) Glass Beads Used in Traffic Paint

AASHTO M 248 (1991I) Ready-Mixed White and Yellow Traffic Paints

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment Lists; GA.

Lists of proposed equipment to be used in performance of construction work, including descriptive data, and notifications of proposed Contractor actions as specified in this section.

SD-06 Instructions

Mixing, Thinning and Application; FIO.

Manufacturer's current printed product description and Material Safety Data Sheets (MSDS) for each type paint/color proposed for use.

SD-09 Reports

Material Tests; FIO.

Certified copies of the test reports, prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory.

SD-13 Certificates

Volatile Organic Compound (VOC) Content; FIO.

Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

1.3 DELIVERY AND STORAGE

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.4 EQUIPMENT

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Equipment operating on roads and runways will display low speed traffic markings and traffic warning lights.

1.4.1 Paint Application Equipment

The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 8 kilometers per hour, and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph APPLICATION, and of even uniform thickness with clear-cut edges. Equipment used for marking streets and highways shall be capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines or a combination of solid and intermittent lines using a maximum of two different colors of paint as specified. The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gauges to apply paint in accordance with requirements specified. Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to insure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

1.4.2 Not Used

1.4.3 Reflective Media Dispenser

The dispenser for applying the reflective media shall be attached to the paint dispenser and operate automatically and simultaneously with the applicator through the same control mechanism. The dispenser shall be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION at all operating speeds of the applicator to which it is attached.

1.4.4 Not Used

1.4.5 Surface Preparation Equipment

1.4.5.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 70.8 liters per sec of air at a pressure of not less than 620 kPa at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

1.4.5.2 Waterblast Equipment

The water pressure shall be specified at 17.9 MPa at 60° in order to adequately clean the surfaces to be marked.

1.4.6 Traffic Controls

Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

1.5 HAND-OPERATED, PUSH-TYPE MACHINES

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces shall be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

PART 2 PRODUCTS

2.1 PAINT

The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of six (6) months. Paint for roads and streets shall conform to AASHTO M 248, color as indicated. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

2.2 NOT USED

2.3 NOT USED

2.4 NOT USED

2.5 REFLECTIVE MEDIA

Reflective media for roads and streets shall conform to AASHTO M 247, Type I.

2.6 SAMPLING AND TESTING

Materials proposed for use shall be stored on the project site in sealed and labeled containers, or segregated at source of supply, sufficiently in advance of needs to allow 60 days for testing. Upon notification by the Contractor that the material is at the site or source of supply, a sample shall be taken by random selection from sealed containers by the Contractor in the presence of a representative of the Contracting Officer. Samples shall be clearly identified by designated name, specification number, batch number, manufacturer's formulation number, project contract number, intended use, and quantity involved. Testing shall be performed in an approved independent laboratory. If materials are approved based on reports furnished by the Contractor, samples will be retained by the Government for possible future testing should the material appear defective during or after application.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Newly laid asphalt and concrete pavements shall be allowed to age for 30 days prior to application of striping. Surfaces to be marked shall be thoroughly cleaned before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

3.1.1 Pretreatment for Early Painting

Where early painting is required on rigid pavements, a pretreatment with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride shall be applied to prepared pavement areas prior to painting.

3.1.2 Cleaning Existing Pavement Markings

In general, markings shall not be placed over existing pavement marking patterns. Existing pavement markings that are in good condition that interfere with or conflict with the newly applied marking patterns shall be removed. Deteriorated or obscured markings that are not misleading or confusing or interfere with the adhesion of the new marking material do not require removal. New preformed and thermoplastic pavement markings shall not be applied over existing preformed or thermoplastic markings. Whenever grinding, scraping, sandblasting or other operations are performed the work must be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.1.3 Cleaning Concrete Curing Compounds

On new portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new concrete pavements shall be cleaned by either sandblasting or water blasting. When water blasting is performed, thermoplastic and preformed markings shall be applied no sooner than 24 hours

after the blasting has been completed. The extent of the blasting work shall be to clean and prepare the concrete surface as follows:

a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.

b. There are no heavy puddled deposits of curing compound in the valleys of the textured concrete surface.

c. All remaining curing compound is intact; all loose and flaking material is removed.

d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.

e. The surface to be marked is dry.

3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans.

3.2.1 Paint

Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 5°C and less than 35°C. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically with approved equipment at rate of coverage specified herein. The Contractor shall provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

3.2.1.1 Rate of Application

Reflective Markings: Pigmented binder shall be applied evenly to the pavement area to be coated at a rate of 10 plus or minus 0.5 square meter per liter. Glass spheres shall be applied uniformly to the wet paint 0.7 plus or minus 0.06 kilograms of glass spheres per liter of paint.

Nonreflective Markings: Paint shall be applied evenly to the pavement surface to be coated at a rate of 10 plus or minus 0.5 square meter per liter.

3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

--End of Section--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION DISCOM PROJECT - PHASE I/IIA, FORT CAMPBELL, KENTUCKY				CONTRACTOR										SPEC. SECTION 02580
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. SD-01 Data										
		1	Equipment Lists; GA.										
			SD-06 Instructions										
		2	Mixing, Thinning and Application; FIO.										
			SD-09 Reports										
		3	Material Tests; FIO.										
			SD-13 Certificates										
		4	Volatile Organic Compound (VOC) Content; FIO.										

*** SAFETY PAYS ***

***** SAFETY PAYS *****

SECTION 02620

SUBDRAINAGE SYSTEM
08/97

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3.1 EXCAVATION AND BEDDING FOR SUBDRAIN SYSTEMS 02620-4
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SECTION 02620

SUBDRAINAGE SYSTEM
08/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2751 (1993) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings

ASTM D 3034 (1994) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

ASTM D 3212 (1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

ASTM D 5034 (1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)

ASTM F 405 (1996) Corrugated Polyethylene (PE) Tubing and Fittings

ASTM F 758 (1993) Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage

ASTM F 949 (1994) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

KENTUCKY DEPARTMENT OF HIGHWAYS (KDOH)

KDOH (1998) Standard Specifications for Road and Bridge Construction

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-01 Data

Subdrain Grade Spreadsheet; GA.

Contractor furnished spreadsheet shall provide all information required to determine conformance with grade requirements for the 150 mm subdrain system. The submittal must contain sufficient information in the format presented to determine if it will be acceptable. The spreadsheet should be adaptable to changing elevations as the project progresses through the subgrade up through and including the final surfacing. The tolerances should be readily identifiable and any nonconforming features shall be highlighted and grade separation shown.

SD-13 Certificates

Filter Fabric; GA.

Pipe for Subdrains; FIO.

Certifications from the manufacturers attesting that materials meet specification requirements. Certificates are required for drain pipe, drain tile, fittings, and filter fabric.

SD-14 Samples

Filter Fabric; FIO.

Pipe for Subdrains; FIO.

Samples of filter fabric, pipe, and pipe fittings, before starting the work.

1.3 DELIVER, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with minimum handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. During shipment and storage, filter fabric shall be wrapped in burlap or similar heavy duty protective covering. The storage area shall protect the fabric from mud, soil, dust, and debris. Filter fabric materials that are not to be installed immediately shall not be stored in direct sunlight. Plastic pipe shall be installed within 6 months from the date of manufacture unless otherwise approved.

1.3.2 Handling

Materials shall be handled in such a manner as to insure delivery to the trench in sound undamaged condition. Pipe shall be carried and not dragged to the trench.

PART 2 PRODUCTS

2.1 PIPE FOR SUBDRAINS

Pipe for subdrains shall be of the types and sizes indicated. Non-perforated pipe shall be used at turnout from underdrains to connection with storm drainage system.

2.1.1 thru 2.1.10 Not Used

2.1.11 Plastic Pipe

Plastic pipe shall contain ultraviolet inhibitor to provide protection from exposure to direct sunlight.

2.1.11.1 Acrylonitrile-Butadiene-Styrene (ABS) Piping

Acrylonitrile-butadiene-styrene (ABS) piping and fittings shall conform to ASTM D 2751, with maximum SDR of 35.

2.1.11.2 Polyvinyl Chloride (PVC) Pipe and Fittings

Polyvinyl chloride (PVC) pipe and fittings shall conform to ASTM F 758, Type PS 46.

2.1.11.3 Corrugated Polyethylene (PE) Pipe and Fittings

Use ASTM F 405 for pipes 80 to 150 mm in diameter, inclusive. Fittings shall be manufacturer's standard type and shall conform to the indicated specification.

2.1.11.4 Pipe Perforations

Water inlet area shall be a minimum of 1,058.4 mm squared per linear meter. Manufacturer's standard perforated pipe which essentially meets these requirements may be substituted with prior approval of the Contracting Officer.

a. Circular Perforations in Plastic Pipe: Circular holes shall be cleanly cut not more than 9.5 mm or less than 4.8 mm in diameter and arranged in rows parallel to the longitudinal axis of the pipe. Perforations shall be approximately 76.2 mm center-to-center along rows. The rows shall be approximately 38.1 mm apart and arranged in a staggered pattern so that all perforations lie at the midpoint between perforations in adjacent rows. The rows shall be spaced over not more than 155 degrees of circumference. The spigot or tongue end of the pipe shall not be perforated for a length equal to the depth of the socket, and perforations shall continue at uniform spacing over the entire length of the pipe.

b. Slotted Perforations in Plastic Pipe: Circumferential slots shall be cleanly cut so as not to restrict the inflow of water and uniformly spaced along the length and circumference of the tubing. Width of slots shall not exceed 3.2 mm nor be less than 0.8 mm. The length of individual slots shall not exceed 31.75 mm on 80 mm diameter tubing, 10 percent of the tubing inside nominal circumference on 100 to 200 mm diameter tubing, and 63.5 mm on 250 mm diameter tubing. Rows of slots shall be symmetrically spaced so that they are fully contained in 2 quadrants of the pipe. Slots shall be centered in the valleys of the corrugations of profile wall pipe.

2.2 FILTER FABRIC

Filter fabric shall be a nonwoven pervious sheet of polyester, nylon, or polypropylene filaments formed into a uniform pattern with distinct and measurable openings. The filter fabric shall provide an equivalent opening size (AOS) no finer than the US Standard Sieve No. 100 and no coarser than the US Standard Sieve No. 70. AOS is defined as the number of the US Standard sieve having openings closest in size to the filter fabric openings. The filaments shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of propylene, ethylene, or vinylidene-chloride, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. The fabric shall have a minimum physical strength of 17.5 kN per meter in any direction when tested in accordance with ASTM D 5034 using the grab test method with 645.2 square mm jaws and a constant rate of travel of 304.8 mm per minute. Elongation at failure shall be between 30 and 70 percent. The fabric shall be constructed so that the filaments will retain their relative position with respect to each other. The edges of the fabric shall be selvaged or otherwise finished to prevent the outer material from pulling away from the fabric. The fabric shall be provided in a width that may be installed as shown without longitudinal seams.

2.3 NOT USED

2.4 SUBDRAIN FILTER AND BEDDING MATERIAL

Subdrain filter and bedding material shall be washed sand, sand and gravel, crushed stone, crushed stone screenings, or slag composed of hard, tough, durable particles free from adherent coatings. Filter material shall not contain corrosive agents, organic matter, or soft, friable, thin, or elongated particles and shall be evenly graded between the limits specified in KDOT SECTION 805 for # 57 Aggregate. Gradation curves will exhibit no abrupt changes in slope denoting skip or gap grading. Filter materials shall be clean and free from soil and foreign materials. Filter blankets found to be dirty or otherwise contaminated shall be removed and replaced with material meeting the specific requirements, at no additional cost to the Government.

PART 3 EXECUTION

3.1 EXCAVATION AND BEDDING FOR SUBDRAIN SYSTEMS

Trenching and excavation, including the removal of rock and unstable material, shall be in accordance with Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Bedding material shall be placed in the trench as indicated or as required as replacement materials used in those areas where unstable materials were removed. Compaction of the bedding material shall be as specified for cohesionless material in Section 02316EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2 FLUSHING AND OBSERVATION RISERS (CLEANOUTS)

3.2.1 NOT USED

3.2.2 Flushing and Observation Risers

Flushing and observation riser pipes with frames and covers shall be installed at the locations indicated. When not shown on the drawings they shall be installed at 120 m center to center spacing along a run of subdrainage. Risers shall be constructed as shown on the drawings. Joining of riser pipes to the subdrain system shall be as indicated.

3.3 INSTALLATION OF FILTER FABRIC AND PIPE FOR SUBDRAINS

3.3.1 Installation of Filter Fabric

3.3.1.1 Not Used

3.3.1.2 Not Used

3.3.1.3 Trench Lining and Overlaps

Trenches to be lined with filter fabric shall be graded to obtain smooth side and bottom surfaces so that the fabric will not bridge cavities in the soil or be damaged by projecting rock. The fabric shall be laid flat but not stretched on the soil, and it shall be secured with anchor pins. Overlaps shall be at least 300 mm, and anchor pins shall be used along the overlaps.

3.3.2 Installation of Pipe for Subdrains

3.3.2.1 Pipelaying

Each pipe shall be carefully inspected before it is laid. Any defective or damaged pipe shall be rejected. No pipe shall be laid when the trench conditions or weather is unsuitable for such work. Water shall be removed from trenches by sump pumping or other approved methods. The pipe shall be laid to the grades and alignment as indicated. The pipe shall be bedded to the established gradeline. Perforations shall be centered on the bottom of the pipe. Pipes of either the bell-and-spigot type or the tongue-and-groove type shall be laid with the bell or groove ends upstream. All pipes in place shall be approved before backfilling.

3.3.2.2 Jointings

a. Acrylonitrile-Butadiene-Styrene (ABS): Solvent cement or elastomeric joints for ABS pipe shall be in accordance with ASTM D 2751. Dimensions and tolerances shall be in accordance with TABLE II of ASTM D 2751.

b. Polyvinyl Chloride (PVC) Pipe: Joints shall be in accordance with the requirements of ASTM D 3034, ASTM D 3212, or ASTM F 949.

c. Perforated Corrugated Polyethylene Pipe: Perforated corrugated polyethylene drainage pipe shall be installed in accordance with the manufacturer's specifications and as specified herein. A pipe with physical imperfections shall not be installed. No more than 5 percent stretch in a section will be permitted.

3.4 NOT USED

3.5 INSTALLATION OF FILTER MATERIAL AND BACKFILLING FOR SUBDRAINS

After pipe for subdrains has been laid, inspected, and approved, filter material shall be placed around and over the pipe to the depth indicated. The filter material shall be placed in layers not to exceed 200 mm thick, and each layer shall be thoroughly compacted by mechanical tampers or rammers to obtain the required density. Compaction of filter material and the placement and compaction of overlying backfill material shall be in accordance with the applicable provisions specified in Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.6 TESTS

3.6.1 Pipe Test

Strength tests of pipe shall conform to field service test requirements of the Federal Specification, ASTM specification.

--End of Section--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION DISCOM Barracks Complex Phase 1, Fort Campbell, KY				CONTRACTOR									SPEC. SECTION 02620	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Subdrain Grade Spreadsheet; GA.										
			SD-13 Certificates										
		2	Filter Fabric; GA.										
		3	Pipe for Subdrains; FIO.										
			SD-14 Samples										
		4	Filter Fabric; FIO.										
		5	Pipe for Subdrains; FIO.										

SAFETY PAYS

SECTION 02660

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1994a) Carbon Structural Steel
ASTM A 53	(1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM C 76	(1995) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM D 1599	(1988) Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
ASTM D 1784	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(1993) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1993) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(1993) Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(1990) Heat-Joining Polyolefin Pipe and Fittings
ASTM D 2774	(1972; R 1983) Underground Installation of Thermoplastic Pressure Piping

ASTM D 2855	(1993) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM F 477	(1993) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1992) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B36.10M	(1985; R 1994) Welded and Seamless Wrought Steel Pipe

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(1992) Hypochlorites
AWWA B301	(1992) Liquid Chlorine
AWWA C104	(1990) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105	(1988) Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1988) Flanged Ductile-Iron Pipe with Threaded Flanges
AWWA C151	(1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C153	(1994) Ductile-Iron Compact Fittings, 3 In. Through 16 In., for Water and Other Liquids
AWWA C500	(1993) Gate Valves for Water and Sewerage Systems
AWWA C502	(1985) Dry-Barrel Fire Hydrants
AWWA C509	(1994) Resilient-Seated Gate Valves for Water and Sewerage Systems

AWWA C600	(1993) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C606	(1987) Grooved and Shouldered Joints
AWWA C651	(1992) Disinfecting Water Mains
AWWA C800	(1989) Underground Service Line Valves and Fittings
AWWA C900	(1989; C900a) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution
AWWA C905	(1988) Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In. Through 36 In.
AWWA M23	(1980) Manual: PVC Pipe - Design and Installation

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA-01	(1992; Errata May 1993) Thrust Restraint Design for Ductile Iron Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGSINDUSTRY (MSS)

MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	(1995) Installation of Private Fire Service Mains and Their Appurtenances
NFPA 49	(1994) Hazardous Chemicals Data
NFPA 325	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 704	(1996) Identification of the Fire Hazards of Materials
NFPA 1961	(1997) Fire Hose

NSF INTERNATIONAL (NSF)

NSF Std 14	(1965; Rev Nov 1990) Plastics Piping System Components and Related Materials

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 21	(1991) White or Colored Silicone Alkyd Paint

SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)

1.2 PIPING

This section covers water distribution and service lines, and connections to building service at a point approximately 1.5 m outside buildings and structures to which service is required. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

1.2.1 Service Lines

Piping for water service lines less than 80 mm (3 inches) in diameter shall be galvanized steel, polyvinyl chloride (PVC) plastic, polyethylene, or copper tubing, unless otherwise shown or specified. Piping for water service lines for sizes 80 mm (3 inches) and larger shall be ductile iron or polyvinyl chloride (PVC) plastic through 300 mm (12 inch) nominal diameter, unless otherwise shown or specified.

1.2.2 Distribution Lines 80 mm (3 Inches) or Larger

Piping for water distribution lines 80 mm (3 inches) or larger shall be ductile iron or polyvinyl chloride (PVC) plastic through 300 mm (12 inch) nominal diameter, unless otherwise shown or specified.

1.2.3 NOT USED

1.2.4 Sprinkler Supply Lines

Piping for water lines supplying sprinkler systems for building fire protection shall conform to NFPA 24 from the point of connection with the water distribution system to the building 1.5 m line.

1.2.5 Plastic Pipe

All plastic piping system components (PVC) intended for transportation of potable water shall comply with NSF Std 14 and shall be legibly marked with their symbol.

1.2.6 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

1.3 NOT USED

1.4 NOT USED

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Installation; FIO.

The manufacturer's recommendations for each material or procedure to be utilized.

SD-08 Statements

Waste Water Disposal Method; GA.

The method proposed for disposal of waste water from hydrostatic tests and disinfection, prior to performing hydrostatic tests.

Satisfactory Installation; FIO.

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

SD-09 Reports

Bacteriological Disinfection; FIO.

Test results from commercial laboratory verifying disinfection.

SD-13 Certificates

Installation; FIO.

A statement signed by the manufacturer's field representative certifying that the Contractor's personnel are capable of properly installing the pipe on the project.

1.6 HANDLING

Pipe and accessories shall be handled so as to ensure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

1.6.1 NOT USED

1.6.2 NOT USED

1.6.3 Miscellaneous Plastic Pipe and Fittings

Polyvinyl Chloride (PVC) pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325M.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 NOT USED

2.1.2 Plastic Pipe

2.1.2.1 NOT USED

2.1.2.2 Polyvinyl Chloride (PVC) Plastic Pipe

Pipe, couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B.

a. Pipe Less Than 100 mm (4 inch) Diameter:

(1) Elastomeric-Gasket Joint: Pipe shall conform to dimensional requirements of ASTM D 1785. Schedule 40 with joints meeting the requirements of 1.03 MPa (150 psi) working pressure, 1.38 MPa (200 psi) hydrostatic test pressure, unless otherwise shown or specified, or it may be pipe conforming to requirements of ASTM D 2241, elastomeric joint, with the following applications:

SDR	Maximum Working Pressure Mpa	Minimum Hydrostatic Pressure MPa
26	0.689	0.917
21	0.827	1.103
17	1.034	1.379
13.5	1.379	1.834

(2) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 1.03 MPa (150 psi) working pressure and 1.38 MPa (200 psi) hydrostatic test pressure.

b. Pipe 100 mm (4 inch) through 300 mm (12 Inch) Diameter: Pipe, couplings and fittings shall conform to AWWA C900, Class 150, CIOD pipe dimensions, elastomeric-gasket joint, unless otherwise shown or specified.

c. Pipe 350 mm (14 Inch) through 900 mm (36 Inch) Diameter: Pipe shall conform to AWWA C905 unless otherwise shown or specified.

2.1.3 NOT USED

2.1.4 NOT USED

2.1.5 Ductile-Iron Pipe

Ductile-iron pipe shall conform to AWWA C151, working pressure not less than 1.03 MPa (150 psi), unless otherwise

shown or specified. Pipe shall be cement-mortar lined in accordance with AWWA C104. Linings shall be standard. When installed underground, pipe shall be encased with 8 mil thick polyethylene in accordance with AWWA C105. Flanged ductile iron pipe with threaded flanges shall be in accordance with AWWA C115.

2.2 FITTINGS AND SPECIALS

2.2.1 NOT USED

2.2.2 Polyvinyl Chloride (PVC) Pipe

a. For pipe less than 100 mm (4 inch) diameter, fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings, fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467, and fittings for elastomeric-gasket joint pipe shall be iron conforming to AWWA C110 or AWWA C111. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104.

b. For pipe 100 mm (4 inch) diameter and larger, fittings and specials shall be iron, bell end in accordance with AWWA C110, 1.03 MPa (150 psi) pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or may be fittings and specials of the same material as the pipe with elastomeric gaskets, all in conformance with AWWA C900. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Fittings shall be bell and spigot or plain end pipe, or as applicable. Ductile iron compact fittings shall be in accordance with AWWA C153.

2.2.3 NOT USED

2.2.4 Ductile-Iron Pipe

Fittings and specials shall be suitable for 1.03 MPa (150 psi) pressure rating, unless otherwise specified. Fittings and specials for mechanical joint pipe shall conform to AWWA C110. Fittings and specials for use with push-on joint pipe shall conform to AWWA C110 and AWWA C111. Fittings and specials for grooved and shouldered end pipe shall conform to AWWA C606. Fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Ductile iron compact fittings shall conform to AWWA C153.

2.3 JOINTS

2.3.1 NOT USED

2.3.2 Plastic Pipe

2.3.2.1 NOT USED

2.3.2.2 Polyvinyl Chloride Pipe

Joints, fittings, and couplings shall be as specified for PVC pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations as approved by the Contracting Officer.

2.3.3 NOT USED

2.3.4 NOT USED

2.3.5 Ductile-Iron Pipe

a. Mechanical joints shall be of the stuffing box type and shall conform to AWWA C111.

b. Push-on joints shall conform to AWWA C111.

c. Rubber gaskets and lubricant shall conform to the applicable requirements of AWWA C111.

2.4 VALVES

2.4.1 NOT USED

2.4.2 Gate Valves

Gate valves shall be designed for a working pressure of not less than 1.03 MPa (150 psi). Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

a. Valves 80 mm (3 inches) and larger shall be iron body, bronze mounted, and shall conform to AWWA C500.

b. Resilient-Seated Gate Valves: For valves 80 to 300 mm (3 to 12 inches) in size, resilient-seated gate valves shall conform to AWWA C509.

2.4.3 through 2.4.5 NOT USED

2.4.6 Indicator Post for Valves

Each valve shown on the drawings with the designation "P.I.V." shall be equipped with indicator post conforming to the requirements of NFPA 24. Operation shall be by a wrench which will be attached to each post.

2.5 VALVE BOXES

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 5 mm. Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment. The word "WATER" shall be cast in the cover. The box length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

2.6 NOT USED

2.7 FIRE HYDRANTS

Hydrants shall be dry-barrel type conforming to AWWA C502 with valve opening at least 125 mm (5 inches) in diameter and designed so that the flange at the main valve seat can be removed with the main valve seat apparatus remaining intact, closed and reasonably tight against leakage and with a breakable valve rod coupling and breakable flange connections located no more than 200 mmabove the ground grade. Hydrants shall have a 150 mm (6 inch) bell connection, two 65 mm (2-1/2 inch) hose connections and one 115 mm (4-1/2 inch) pumper connection. Outlets shall have American National Standard fire-hose coupling threads. Working parts shall be bronze. Design, material, and workmanship shall be similar and equal to the latest stock pattern ordinarily produced by the manufacturer. Hydrants

shall be painted with one coat of red iron oxide, zinc oxide primer conforming to SSPC Paint 25 and two finish coats of silicone alkyd paint conforming to SSPC Paint 21, of the installation's standard colors or as directed by the Contracting Officer. Suitable bronze adapter for the 115 mm (4-1/2 inch) outlet, with caps, shall be furnished.

2.8 MISCELLANEOUS ITEMS

2.8.1 through 2.8.4 NOT USED

2.8.5 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable-iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 1.03 MPa (150 psi). Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 67.8 Newton meters (50 foot-pound).

2.8.6 Service Boxes

Service boxes shall be cast iron or concrete and shall be extension service boxes of the length required for the depth of the line, with either screw or slide-type adjustment. The boxes shall have housings of sufficient size to completely cover the service stop or valve and shall be complete with identifying covers.

2.8.7 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable. Squeeze type mechanical cutters shall not be used for ductile iron.

3.1.2 Adjacent Facilities

3.1.2.1 Sewer Lines

Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 3 m from a sewer except where the bottom of the water pipe will be at least 300 mm above the

top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 1.8 m from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe for a distance of at least 3 meach side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 900 mm horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 600 mm above the sewer main. Joints in the sewer main, closer horizontally than 900 mm to the crossing, shall be encased in concrete.

3.1.2.2 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

3.1.2.3 NOT USED

3.1.2.4 NOT USED

3.1.2.5 Casing Pipe

Water pipe shall be encased in a sleeve of rigid conduit as required. Where sleeves are required the pipe sleeve shall be steel, manufactured in accordance with AWWA C200, ASTM A 36, or reinforced concrete in accordance with ASTM C 76, Class V and as specified for storm drains in Section 02720 STORM-DRAINAGE SYSTEM. A minimum clearance of at least 50 mm between the inner wall of the sleeve and the maximum outside diameter of the sleeved pipe and joints shall be provided. Sand bedding or suitable pipe support shall be provided for the water pipe through the sleeve.

3.1.2.6 Structures

Where water pipe is required to be installed within 1 m of existing structures, the water pipe shall be sleeved as required in Paragraph "Casing Pipe". The Contractor shall take proper precautions during installation of the water pipe and sleeve to ensure that there will be no damage to the structures and no settlement or movement of foundations or footings.

3.1.3 Joint Deflection

3.1.3.1 NOT USED

3.1.3.2 Flexible Plastic Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but in no case shall it exceed 5 degrees.

3.1.3.3 Ductile-Iron Pipe

The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Under no circumstances shall any of the water-line materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Except where necessary in making connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying.

The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as shown.

3.1.4.1 NOT USED

3.1.4.2 Plastic Pipe Installation

PVC pipe shall be installed in accordance with AWWA M23.

3.1.4.3 Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. When made under pressure, these connections shall be installed using standard methods as approved by the Contracting Officer. Connections to existing asbestos-cement pipe shall be made in accordance with ACPPA-01.

3.1.4.4 Penetrations

Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

3.1.5 Jointing

3.1.5.1 NOT USED

3.1.5.2 NOT USED

3.1.5.3 Polyvinyl Chloride (PVC) Plastic Pipe

a. Pipe less than 100 mm (4 inch) diameter: Threaded joints shall be made by wrapping the male threads with approved thread tape or applying an approved lubricant, then threading the joining members together. The joint shall be tightened using strap wrenches to prevent damage to the pipe and/or fitting. To avoid excessive torque, joints shall be tightened no more than one thread past hand-tight. Preformed rubber-ring gaskets for elastomeric-gasket joints shall be made in accordance with requirements of ASTM F 477 and as required herein. All pipe ends for push-on joints shall be beveled to facilitate assembly and marked to indicate when the pipe is fully seated. The gasket shall be prelubricated to prevent displacement. The gasket and ring groove in the bell or coupling shall match. The manufacturer of the pipe or fitting shall supply the elastomeric gasket. Couplings shall be provided with stops or centering rings to assure that the coupling is centered on the joint. Solvent cement joints shall use sockets conforming to the requirements of ASTM D 2467. The solvent cement used shall meet the requirements of ASTM D 2564; the joint assembly shall be made in accordance with ASTM D 2855 and the manufacturer's specific recommendations.

b. Pipe 100 mm (4 inch) through 300 mm (12 inch) diameter: Joints shall be elastomeric-gasket as specified in AWWA C900. Jointing procedure shall be as specified for pipe less than 100 mm (4 inch) diameter with configuration using elastomeric ring gasket.

3.1.5.4 NOT USED

3.1.5.5 Ductile-Iron Pipe

Mechanical and push-on type joints shall be installed in accordance with AWWA C600 for buried lines or AWWA C606 for grooved and shouldered pipe above ground or in pits.

3.1.5.6 through 3.1.5.10 NOT USED

3.1.5.11 Connections

Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

3.1.6 Service Lines

Service lines shall include the pipeline connecting building piping to water distribution lines to the connections with the building service at a point approximately 1.5 m outside the building where such building service exists. Where building services are not installed, the Contractor shall terminate the service lines approximately 1.5 m from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps. All service stops and valves shall be provided with service boxes. Service lines shall be constructed in accordance with the following requirements:

3.1.6.1 through 3.1.6.3 NOT USED

3.1.6.4 Service Lines Larger than 50 mm (2 Inches)

Service lines larger than 50 mm (2 inches) shall be connected to the main by a tapped saddle, tapping sleeve and valve, service clamp or reducing tee, depending on the main diameter and the service line diameter, and shall have a gate valve. Lines 80 mm (3 inches) and larger may use rubber-seated butterfly valves as specified above, or gate valves.

3.1.6.5 Service Lines for Sprinkler Supplies

Water service lines used to supply building sprinkler systems for fire protection shall be connected to the water distribution main in accordance with NFPA 24.

3.1.7 NOT USED

3.1.8 Setting of Fire Hydrants, Valves and Valve Boxes

3.1.8.1 Fire Hydrants

Fire hydrants shall be located and installed as shown. Each hydrant shall be connected to the main with a 150 mm (6 inch) branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with pumper nozzle facing the roadway, with the center of the lowest outlet not less than 450 mm above the finished surrounding grade, and the operating nut not more than 1.2 m above the finished surrounding grade. Fire hydrants designated on the drawings as low profile shall have the lowest outlet not less than 450 mm above the finished surrounding grade, the top of the hydrant not more than 600 mm above the finished surrounding grade. Except where approved otherwise, the backfill around hydrants shall be thoroughly compacted to the finished gradeline immediately after installation to obtain

beneficial use of the hydrant as soon as practicable. Not less than 2 cubic meters of free-draining broken stone or gravel shall be placed around and beneath the waste opening of dry barrel hydrants to ensure drainage.

3.1.8.2 NOT USED

3.1.8.3 Valves

After delivery, valves, including those in hydrants, shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and hydrants and valves shall be fully opened and fully closed to ensure that all parts are in working condition. Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be carefully tamped around each valve box or pit to a distance of 1.2 m on all sides of the box, or the undisturbed trench face if less than 1.2 m.

3.1.8.4 Service Boxes

Where water lines are located below paved streets having curbs, the boxes shall be installed directly back of the curbs. Where no curbing exists, service boxes shall be installed in accessible locations, beyond the limits of street surfacing, walks and driveways.

3.1.9 Tapped Tees and Crosses

Tapped tees and crosses for future connections shall be installed where shown.

3.1.10 Thrust Restraint

Plugs, caps, tees and bends deflecting 11-1/4 degrees or more, either vertically or horizontally, on waterlines 100 mm (4 inches) in diameter or larger, and fire hydrants shall be provided with thrust restraints. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron pipes, restrained joints.

3.1.10.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 14 Mpa after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.10.2 Restrained Joints

For ductile-iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA-01.

3.2 HYDROSTATIC TESTS

Where any section of a water line is provided with concrete thrust blocking for fitting or hydrants, the hydrostatic tests

shall not be made until at least 5 days after installation of the concrete thrust blocking, unless otherwise approved.

3.2.1 Pressure Test

After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 1.38 MPa (200 psi). Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves, discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions is encountered:

a. Wet or unstable soil conditions in the trench.

b. Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions.

c. Maintaining the trench in an open condition would delay completion of the contract.

The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2.2 Leakage Test

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to not less than 1.38 MPa (200 psi) pressure. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain pressure within 34.5 kPa (5 psi) of the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

L = 0.0001351ND(P raised to 1/2 power)

L = Allowable leakage in gallons per hour
N = Number of joints in the length of pipeline tested
D = Nominal diameter of the pipe in inches
P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

3.2.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Cement-mortar lined pipe may be filled with water as

recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

3.2.4 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be satisfactory as specified. All replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

a. Pressure test and leakage test may be conducted concurrently.

b. Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.

3.3 DISINFECTION

3.3.1 Bacteriological Disinfection

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as prescribed by AWWA C651. From several points in the system, Contracting Officer personnel shall take at least 3 water samples from different points in properly sterilized containers. Fort Campbell Water Plant personnel shall perform a bacterial examination in accordance with State of Tennessee approved methods. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.4 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

--END OF SECTION--

SECTION 02660

WATER DISTRIBUTION SYSTEM

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SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION			Discom Barracks Complex, Phase I Ft. Campbell, Kentucky		CONTRACTOR									SPEC. SECTION 02660
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.5 SUBMITTALS										
			SD-06 Instructions										
			Installation; FIO.										
			SD-08 Statements										
			Waste Water Disposal Method; GA.										
			Satisfactory Installation; FIO.										
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SAFETY PAYS

SECTION 02685

GAS DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN GAS ASSOCIATION (AGA)

AGA-01	(1989) A.G.A. Plastic Pipe Manual for Gas Service

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B109.2	(1992) Diaphragm Type Gas Displacement Meters (Over 500 Cubic Feet per Hour Capacity)

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 5L	(1995) Line Pipe
API Spec 6D	(1994; Specification for Pipeline Valves, (Gate, Plug, Ball, and Check Valves)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1995) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 181	(1995a) Forgings, Carbon Steel, for General-Purpose Piping
ASTM D 2513	(1995b Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D 2517	(1994) Reinforced Epoxy Resin Gas Pressure Pipe and Fittings
ASTM D 2683	(1993) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D 3261	(1993) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM D 3308	(1991a) PTFE Resin Skived Tape
ASTM D 3350	(1993) Polyethylene Plastics Pipe and Fittings Materials

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.5	(1988; Errata Oct 1988; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.40	(1985; R 1994) Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems
ASME B31.8	(1992; B31.8a; B31.8b; B31.8c) Gas Transmission and Distribution Piping Systems
ASME BPV VIII Div 1	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

CODE OF FEDERAL REGULATIONS (CFR)

49 CFR 192	Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGSINDUSTRY (MSS)

MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-84	(1990) Valves - Socket Welding and Threaded Ends

NACE INTERNATIONAL (NACE)

NACE RP 0274	(1993) High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation
NACE 0185	(1985) Extruded, Polyolefin Resin Coating Systems for Underground or Submerged Pipe

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 21	(1991) White or Colored Silicone Alkyd Paint
SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)
SSPC Paint 101	(1991) Aluminum Alkyd Paint
SSPC Paint 104	(1991) White or Tinted Alkyd Paint
SSPC SP 1	(1982) Solvent Cleaning
SSPC SP 3	(1995) Power Tool Cleaning
SSPC SP 6	(1994) Commercial Blast Cleaning
SSPC SP 7	(1994) Brush-Off Blast Cleaning

UNDERWRITERS LABORATORIES (UL)

UL-06	(1995; Supple) Gas and Oil Equipment Directory

1.2 GENERAL REQUIREMENTS

1.2.1 NOT USED

1.2.2 Jointing Polyethylene Piping

Piping shall be joined by performance qualified joiners using qualified procedures in accordance with AGA-01. Manufacturer's prequalified joining procedures shall be used. Joints shall be inspected by an inspector qualified in the joining procedures being used and in accordance with AGA-01. Joiners and inspectors shall be qualified at the jobsite by a person who has been trained and certified by the manufacturer of the pipe, to train and qualify joiners and inspectors in each joining procedure to be used on the job. Training shall include use of equipment, explanation of the procedure, and successfully making joints which pass tests specified in AGA-01. The Contracting Officer shall be notified at least 24 hours in advance of the date to qualify joiners and inspectors.

1.2.3 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos shall not be used. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Valves, flanges, and fittings shall be marked in accordance with MSS SP-25.

1.2.4 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.2.5 Handling

Pipe and components shall be handled carefully to ensure a sound, undamaged condition. Particular care shall be taken not to damage pipe coating. No pipe or material of any kind shall be placed inside another pipe or fitting after the coating has been applied, except as specified in paragraph INSTALLATION. Plastic pipe shall be handled in conformance with AGA-01.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Pipe, Fittings, and Associated Materials; GA.

Drawings shall contain complete schematic and piping diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of the system and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-07 Schedules

Equipment and Materials; GA.

A complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions, including, but not limited to the following:

a. Dielectric Unions and Flange Kits.

b. Meters.

c. Pressure Reducing Valves.

d. Regulators.

Spare Parts Data; FIO.

Spare parts lists for each different item of material and equipment specified, after approval of the detail drawings and not later than 3 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Notification; FIO.

Notification of the Contractor's schedule for making connections to existing gas lines, at least 10 days in advance.

SD-08 Statements

Connection Procedures; GA.

A copy of procedures for gas line tie in, hot taps, removal or demolition, purging, and plugging as applicable in accordance with ASME B31.8.

SAFETY PAYS

SD-13 Certificates

Utility Work; FIO.

Certification from the Operating Agency/Utility Company that work for which the Utility is responsible has been completed.

Training; FIO.

A copy of each inspector's and jointer's training certificate with respective test results.

SD-19 Operation and Maintenance Manuals

Gas Distribution System; FIO.

Six copies, in booklet form and indexed, of site specific natural gas operation and maintenance manual for each gas distribution system including system operation, system maintenance, equipment operation, and equipment maintenance manuals described below. If operation and maintenance manuals are provided in a common volume, they shall be clearly differentiated and separately indexed.

The System Operation Manual shall include but not be limited to the following:

a. Maps showing piping layout and locations of all system valves and gas line markers.

b. Step-by-step procedures required for system startup, operation, and shutdown. System components and equipment shall be indexed to the gas maps.

c. Isolation procedures and valve operations to shut down or isolate each section of the system. Valves and other system components shall be indexed to the gas maps.

d. Descriptions of Site Specific Standard Operation Procedures including permanent and temporary pipe repair procedures, system restart and test procedures for placing repaired lines back in service, and procedures for abandoning gas piping and system components.

e. Descriptions of Emergency Procedures including: isolation procedures including required valve operations with valve locations indexed to gas map, recommended emergency equipment, and checklist for major emergencies.

The Equipment Operation Manual shall include but not be limited to detail drawings, equipment data, and manufacturer supplied operation manuals for all equipment, valves and system components.

The System Maintenance Manuals shall include but not be limited to:

a. Maintenance check list for entire gas distribution system.

b. Descriptions of site specific standard maintenance procedures.

c. Maintenance procedures for installed cathodic protection systems.

d. Piping layout, equipment layout, and control diagrams of the systems as installed.

e. Identification of pipe materials and manufacturer by location, pipe repair procedures, and jointing procedures at transitions to other piping materials or piping from different manufacturer.

The Equipment Maintenance Manuals shall include but not be limited to the following:

a. Identification of valves and other equipment by materials, manufacturer, vendor identification and location.

b. Maintenance procedures and recommended maintenance tool kits for all valves and equipment.

c. Recommended repair methods, either field repair, factory repair, or whole-item replacement for each valve component or piece of equipment or component item.

d. Routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide.

PART 2 PRODUCTS

2.1 PIPE, FITTINGS, AND ASSOCIATED MATERIALS

2.1.1 Steel Pipe

Steel pipe shall conform to ASTM A 53, Grade A or B, Type E or S, Schedule 40; or API Spec 5L seamless or electric resistance welded, Schedule 40, black steel pipe as specified in ASME B31.8. Furnace buttwelded pipe may be used in sizes 40 mm (1-1/2 inches) and smaller.

2.1.2 Small Fittings

Fittings 40 mm (1-1/2 inches) and smaller shall conform to ASME B16.11.

2.1.3 Fittings, 50 mm (2 Inches) and Larger

Pipe flanges and flanged fittings including bolts, nuts, and bolt patterns shall be in accordance with ASME B16.5, Class 150. Buttweld fittings shall be in accordance with ASME B16.9. Weld neck flanges shall be used.

2.1.4 Steel Forged Branch Connections

Connections shall conform to ASTM A 181, Class 60, carbon steel.

2.1.5 Flange Gaskets

Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm (1/16 inch) minimum thickness, full face or self-centering flat ring type. The gaskets shall contain aramid fibers bonded with nitrile butadiene rubber (NBR), or glass fibers bonded with polytetrafluorethylene, suitable for maximum 315 degrees C service and meeting applicable requirements of ASME B31.8.

2.1.6 Pipe Threads

Pipe threads shall conform to ASME B1.20.1.

2.1.7 Polyethylene Pipe, Tubing, Fittings and Joints

SAFETY PAYS

Polyethylene pipe, tubing, fittings and joints shall conform to ASTM D 3350 and ASTM D 2513, pipe designations PE 2406 and PE 3408, rated SDR 21 or less, as specified in ASME B31.8. Pipe sections shall be marked as required by ASTM D 2513. Butt fittings shall conform to ASTM D 3261 and socket fittings shall conform to ASTM D 2683. Fittings shall match the service rating of the pipe.

2.1.8 NOT USED

2.1.9 Sealants for Steel Pipe Threaded Joints

2.1.9.1 Sealing Compound

Joint sealing compound shall be as listed in UL-06, Class 20 or less.

2.1.9.2 Tape

Polytetrafluoroethylene tape shall conform to ASTM D 3308.

2.1.10 Identification

Pipe flow markings and metal tags for each valve, meter, and regulator shall be provided as required by the Contracting Officer.

2.1.11 Insulating Joint Materials

Insulating joint materials shall be provided between flanged or threaded metallic pipe systems where shown to isolate galvanic or electrolytic action.

2.1.11.1 Threaded Joints

Joints for threaded pipe shall be steel body nut type dielectric type unions with insulating gaskets.

2.1.11.2 Flanged Joints

Joints for flanged pipe shall consist of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts and insulating washers for flange nuts.

2.1.12 Gas Transition Fittings

Gas transition fittings shall be manufactured steel fittings approved for jointing steel and polyethylene or fiberglass pipe. Approved transition fittings are those that conform to AGA-01 requirements for transition fittings.

2.2 VALVES

Valves shall be suitable for shutoff or isolation service and shall conform to the following:

2.2.1 Steel Valves

Steel valves 40 mm (1-1/2 inches) and smaller installed underground shall conform to MSS SP-84, carbon steel, socket weld ends, with square wrench operator adaptor. Steel valves 40 mm (1-1/2 inches) and smaller installed aboveground shall conform to MSS SP-84, carbon steel, socket weld or threaded ends with handwheel or wrench operator. Steel

valves 50 mm (2 inches) and larger installed underground shall conform to API Spec 6D, carbon steel, buttweld ends, Class 150 with square wrench operator adaptor. Steel valves 50 mm (2 inches) and larger installed aboveground shall conform to API Spec 6D, carbon steel, buttweld or flanged ends, Class 150 with handwheel or wrench operator.

2.2.2 Steel Valve Operators

Valves 200 mm (8 inches) and larger shall be provided with worm or spur gear operators, totally enclosed, grease packed, and sealed. The operators shall have Open and Closed stops and position indicators. Locking feature shall be provided where indicated. Wherever the lubricant connections are not conveniently accessible, suitable extensions for the application of lubricant shall be provided. Valves shall be provided with lubricant compatible with gas service.

2.2.3 Polyethylene Valves

Polyethylene valves shall conform to ASME B16.40. Polyethylene valves, in sizes 15 mm to 150 mm (1/2 inch to 6 inches), may be used with polyethylene distribution and service lines, in lieu of steel valves, for underground installation only.

2.3 PRESSURE REGULATORS

Regulators shall have ferrous bodies, shall provide backflow and vacuum protection, and shall be designed to meet the pressure, load and other service conditions.

2.3.1 NOT USED

2.3.2 Service Line Regulators

Pressure regulators for individual service lines shall have ferrous bodies. Regulator shall be capable of reducing distribution line pressure to pressures required for users. Regulators shall be provided where gas will be distributed at pressures in excess of 2500 Pa (10 inches of water column). Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulator shall have single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet. Regulator valve vent shall be of resilient materials designed to withstand flow conditions when pressed against the valve port. Regulator shall be capable of regulating downstream pressure within limits of accuracy and shall be capable of limiting the buildup of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Regulator shall have a self contained service regulator. Regulator pipe connections shall not exceed 50 mm (2 inch) size.

2.4 METERS

Meters shall conform to ANSI B109.2, Style B without resettable counter. Meters shall be pipe or pedestal mounted and be provided with a strainer immediately upstream. Meters shall be provided with over-pressure protection as specified in ASME B31.8, tamper-proof protection, frost protection, and fungus-proof protection. Meters shall be suitable for accurately measuring and handling gas at pressures, temperatures, and flow rates indicated.

2.5 PROTECTIVE COVERING MATERIALS

2.5.1 Thermoplastic Resin Coating System

Continuously extruded polyethylene and adhesive coating system materials shall conform to NACE RP-0185 Type A.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILLING

Earthwork shall be as specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2 GAS MAINS

Pipe for gas mains shall be polyethylene. Polyethylene mains shall not be installed aboveground.

3.3 SERVICE LINES

Service lines shall be constructed of materials specified for gas mains and shall extend from a gas main to and including the point of delivery within 1.5 meters (5) feet of the building. The point of delivery is the meter set assembly . The service lines shall be connected to the gas mains as indicated. Where indicated, service line shall be provided with an isolation valve of the same size as the service line. The service lines shall be as short and as straight as practicable between the point of delivery and the gas main and shall not be bent or curved laterally unless necessary to avoid obstructions or otherwise permitted. Service lines shall be laid with as few joints as practicable using standard lengths of pipe. Shorter lengths shall be used only for closures. Polyethylene service lines shall not be installed aboveground except as permitted in ASME B31.8.

3.4 WORKMANSHIP AND DEFECTS

Pipe, tubing, and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and blown free of chips and scale. Defective pipe, tubing, or fittings shall be replaced and shall not be repaired.

3.5 PROTECTIVE COVERING

3.5.1 Protective Covering for Underground Steel Pipe

Except as otherwise specified, protective coverings shall be applied mechanically in a factory or field plant especially equipped for the purpose. Valves and fittings that cannot be coated and wrapped mechanically shall have the protective covering applied by hand, preferably at the plant that applies the covering to the pipe. Joints shall be coated and wrapped by hand. Hand coating and wrapping shall be done in a manner and with materials that will produce a covering equal in thickness to that of the covering applied mechanically.

3.5.1.1 Thermoplastic Resin Coating System

The coating system shall conform to NACE RP-0185, Type A. The exterior of the pipe shall be cleaned to a commercial grade blast cleaning finish in accordance with SSPC SP 6. Adhesive compound shall be applied to the pipe. Immediately after the adhesive is applied, a seamless tube of polyethylene shall be extruded over the adhesive to produce a bonded seamless coating. The nominal thickness of the pipe coating system shall be 0.25 mm (10 mils) (plus or minus 10 percent) of adhesive and 1.0 mm (40 mils) (plus or minus 10 percent) of polyethylene for pipes up to 400 mm (16 inches) in diameter. Joint coating and field repair material shall be applied as recommended by the coating manufacturer and shall be one of the following:

a. Heat shrinkable polyethylene sleeves.

b. Polyvinyl chloride pressure-sensitive adhesive tape.

c. High density polyethylene/bituminous rubber compound tape.

The coating system shall be inspected for holes, voids, cracks, and other damage during installation.

3.5.1.2 Inspection of Pipe Coatings

Any damage to the protective covering during transit and handling shall be repaired before installation. After field coating and wrapping has been applied, the entire pipe shall be inspected by an electric holiday detector with impressed current set at a value in accordance with NACE RP 0274 using a full-ring, spring-type coil electrode. The holiday detector shall be equipped with a bell, buzzer, or other type of audible signal which sounds when a holiday is detected. All holidays in the protective covering shall be repaired immediately upon detection. The Contracting Officer reserves the right to inspect and determine the suitability of the detector. Labor, materials, and equipment necessary for conducting the inspection shall be furnished by the Contractor.

3.5.2 Protective Covering for Aboveground Piping Systems

Finish painting shall conform to the applicable paragraphs of Section 09900 PAINTING, GENERAL and as follows:

3.5.2.1 Ferrous Surfaces

Shop primed surfaces shall be touched up with ferrous metal primer same type paint as the shop primer. Surfaces that have not been shop primed shall be solvent-cleaned in accordance with SSPC SP 1. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be mechanically cleaned by power wire brushing in accordance with SSPC SP 3 or brush-off blast cleaned in accordance with SSPC SP 7 and primed with ferrous metal primer in accordance with SSPC Paint 25. Primed surfaces shall be finished with two coats of exterior alkyd paint conforming to SSPC Paint 104.

3.5.2.2 Nonferrous Surfaces

Nonferrous surfaces shall not be painted.

3.5.3 Protective Covering for Piping in Valve Boxes and Manholes

Piping in valve boxes or manholes shall receive protective coating as specified for underground steel pipe.

3.6 INSTALLATION

Gas distribution system and equipment shall be installed in conformance with the manufacturer's recommendations and applicable sections of ASME B31.8, AGA-01 and 49 CFR 192. Pipe shall be cut without damaging the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable. On steel pipe 150 mm (6 inches) and larger, an approved gas-cutting-and-beveling machine may be used. Cutting of plastic pipe shall be in accordance with AGA-01. Valve installation in plastic pipe shall be designed to protect the plastic pipe against excessive torsional or shearing loads when the valve is operated and from other stresses which may be exerted through the valve or valve box.

3.6.1 Installing Pipe Underground

Gas mains and service lines shall be graded as indicated. Steel piping shall be used only where gas piping comes above

ground. All piping underground shall be polyehtylene piping. Joints in steel pipe shall be welded except as otherwise permitted for installation of valves. Mains shall have 600 mm (24 inch) minimum cover; service lines shall have 600 mm (24 inch) minimum cover; and both mains and service lines shall be placed on firmly compacted select material for the full length. Where indicated, the main shall be encased, bridged, or designed to withstand any anticipated external loads as specified in ASME B31.8. The encasement material shall be standard weight black steel pipe with a protective coating as specified. The pipe shall be separated from the casing by insulating spacers and sealed at the ends with casing bushings. Trench shall be excavated below pipe grade, bedded with bank sand, and compacted to provide full-length bearing. Laying the pipe on blocks to produce uniform grade will not be permitted. The pipe shall be clean inside before it is lowered into the trench and shall be kept free of water, soil, and all other foreign matter that might damage or obstruct the operation of the valves, regulators, meters, or other equipment. When work is not in progress, open ends of pipe or fittings shall be securely closed by expandable plugs or other suitable means. Minor changes in line or gradient of pipe that can be accomplished through the natural flexibility of the pipe material without producing permanent deformation and without overstressing joints may be made when approved. Changes in line or gradient that exceed the limitations specified shall be made with fittings. When cathodic protection is furnished, electrically insulated joints or flanges shall be provided. When polyethylene or fiberglass piping is installed underground, foil backed magnetic tape shall be placed above the pipe to permit locating with a magnetic detector. After laying of pipe and testing, trench shall be backfilled in accordance with Section 02316 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITY SYSTEMS.

3.6.2 Installing Pipe Aboveground

Aboveground piping shall be protected against dirt and other foreign matter as specified for underground piping. Joints in steel pipe shall be welded; however joints in pipe 40 mm (1-1/2 inches) in diameter and smaller may be threaded; joints may also be threaded to accommodate the installation of valves. Flanges shall be of the weld neck type to match wall thickness of pipe.

3.7 PIPE JOINTS

Pipe joints shall be designed and installed to effectively sustain the longitudinal pullout forces caused by the contraction of piping or superimposed loads.

3.7.1 Threaded Steel Joints

Threaded joints in steel pipe shall have tapered threads evenly cut and shall be made with UL approved graphite joint sealing compound for gas service or polytetrafluoroethylene tape applied to the male threads only. Caulking of threaded joints to stop or prevent leaks will not be permitted.

3.7.2 Welded Steel Joints

Gas pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.8. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected adversely. Electrodes that have been wetted or have lost any of their coating shall not be used.

3.7.3 Polyethylene Pipe Jointing Procedures

Jointing procedures shall conform to AGA-01. Indiscriminate heat fusion joining of plastic pipe or fittings made from different polyethylene resins by classification or by manufacturer shall be avoided if other alternative joining procedures are available. If heat fusion joining of dissimilar polyethylenes is required, special procedures are required. The method of heat fusion joining dissimilar polyethylene resins shall be tested in accordance with paragraph TESTS, subparagraph Destructive Tests of Plastic Pipe Joints.

3.7.4 Connections Between Metallic and Plastic Piping

Connections shall be made only outside, underground, and with approved transition fittings.

3.8 VALVE BOXES

Valve boxes of cast iron not less than 4.7 mm (3/16 inch) thick shall be installed at each underground valve except where concrete or other type of housing is indicated. Valve boxes shall be provided with locking covers that require a special wrench for removal. Wrench shall be furnished for each box. The word "gas" shall be cast in the box cover. When the valve is located in a roadway, the valve box shall be protected by a suitable concrete slab at least 1 square meter (3 square feet). When in a sidewalk, the top of the box shall be in a concrete slab 600 mm (2 feet) square and set flush with the sidewalk. Boxes shall be adjustable extension type with screw or slide-type adjustments. Valve boxes shall be separately supported, not resting on the pipe, so that no traffic loads can be transmitted to the pipe. Valves shall only be located in valve boxes or inside of buildings.

3.9 DRIPS

Drips shall be installed at locations where indicated. Drips shall conform to the details shown or may be commercial units of approved type and capacity. A blow off pipe 32 mm (1-1/4 inches) or larger shall be connected to each drip at its lowest point and shall extend to or near the ground surface at a convenient location away from traffic. Discharge for each drip terminal (outlet) shall be provided with a reducing fitting, a plug valve, and a 15 mm (1/2 inch) nipple turned down. The discharge terminal (outlet) shall be inside a length of 300 mm or larger vitrified clay pipe, concrete sewer pipe or concrete terminal box set vertically on a bed of coarse gravel 300 mm thick and 1 m square,and closed at the ground surface with a suitable replacement cover.

3.10 PRESSURE REGULATOR INSTALLATION

3.10.1 NOT USED

3.10.2 Service Line Regulators

A shutoff valve, meter set assembly, and service regulator shall be installed on the service line outside the building, 450 mm (18 inches) above the ground on the riser. An insulating joint shall be installed on the inlet side of the meter set assembly and service regulator and shall be constructed to prevent flow of electrical current. A 10 mm (3/8 inch) tapped fitting equipped with a plug shall be provided on both sides of the service regulator for installation of pressure gauges for adjusting the regulator. All service regulator vents and relief vents shall terminate in the outside air in rain and insect resistant fittings. The open end of the vent shall be located where gas can escape freely into the atmosphere, away from any openings into the building and above areas subject to flooding.

3.11 METER INSTALLATION

Meters shall be installed in accordance with ASME B31.8. Permanent gas meters shall be installed with provisions for isolation and removal for calibration and maintenance, and shall be suitable for operation in conjunction with an energy monitoring and control system.

3.12 CONNECTIONS TO EXISTING LINES

Connections between new work and existing gas lines, where required, shall be made in accordance with ASME B31.8 using proper fittings to suit the actual conditions. When connections are made by tapping into a gas main, the connecting fittings shall be the same size as the pipe being connected.

3.12.1 NOT USED

3.12.2 Connection to Government Owned/Operated Gas Lines

The Contractor shall provide connections to the existing gas lines in accordance with approved procedures. Deactivation of any portion of the existing system shall only be done at the valve location shown on the drawings. Reactivation of any existing gas lines will only be done by the Government. The Contractor's Connection Plan shall be submitted and approved prior to making any connections to existing gas lines. This plan shall include the Operating Agency's required procedures which may be obtained from Public Works - Ft. Campbell. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made.

3.13 CATHODIC PROTECTION

Cathodic protection shall be provided for all metallic gas piping installed underground and shall be installed as specified in Section 16640 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE).

3.14 TESTS

3.14.1 Destructive Tests of Plastic Pipe Joints

Each day, prior to making polyethylene heat fusion joints or fiberglass adhesive joints, a joint of each size and type to be installed that day shall be made by each person performing joining of plastic pipe that day and destructively tested. At least 3 longitudinal straps shall be cut from each joint. Each strap shall be visually examined, shall not contain voids or discontinuities on the cut surfaces of the joint area, and shall be deformed by bending, torque, or impact, and if failure occurs, it must not initiate in the joint area. If a joint fails the visual or deformation test, the qualified joiner who made that joint shall not make further field joints in plastic pipe on this job until that person has been retrained and requalified. The results of the destructive tests shall be recorded to include the date and time of the tests, size and type of the joints, ambient conditions, fusion iron temperature and names of inspectors and joiners.

3.14.2 Pressure and Leak Tests

The system of gas mains and service lines shall be tested after construction and before being placed in service using air as the test medium. The normal operating pressure for the system is 186 kPa (27 psi). The test pressure is 276 kPa (40psi). Prior to testing the system, the interior shall be blown out, cleaned and cleared of all foreign materials. All meters, regulators, and controls shall be removed before blowing out and cleaning and reinstalled after clearing of all foreign materials. Testing of gas mains and service lines shall be done with due regard for the safety of employees and the public during the test. Persons not working on the test operations shall be kept out of the testing area while testing is proceeding. The test shall be made on the system as a whole or on sections that can be isolated. Joints in sections shall be tested prior to backfilling when trenches must be backfilled before the completion of other pipeline sections. The test shall continue for at least 24 hours from the time of the initial readings to the final readings of pressure and temperature. The initial test readings of the instrument shall not be made for at least 1 hour after the pipe has been subjected to the full test pressure, and neither the initial nor final readings shall be made at times of rapid changes in atmospheric conditions. The temperatures shall be representative of the actual trench conditions. There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the

relationship T(1)P(2)=T(2)P(1), in which T and P denote absolute temperature and pressure, respectively, and the numbers denote initial and final readings. During the test, the entire system shall be completely isolated from all compressors and other sources of air pressure. Each joint shall be tested by means of soap and water or an equivalent nonflammable solution prior to backfilling or concealing any work. The testing instruments shall be approved by the Contracting Officer. All labor, materials and equipment for conducting the tests shall be furnished by the Contractor and shall be subject to inspection at all times during the tests. The Contractor shall maintain safety precautions for air pressure testing at all times during the tests.

--END OF SECTION--

SECTION 02685

GAS DISTRIBUTION SYSTEM

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SUBMITTAL REGISTER (ER415-1-10)	CONTRACT NO.

TITLE AND LOCATION	CONTRACTOR	SPEC. SECTION
Discom Barracks Complex, Phase I Ft. Campbell, Kentucky		02685

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
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SAFETY PAYS

SECTION 02711

FOUNDATION DRAINAGE SYSTEM
04/89

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SAFETY PAYS

SECTION 02711

FOUNDATION DRAINAGE SYSTEM
04/89

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 252 (1994) Corrugated Polyethylene Drainage Tubing

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2751 (1993) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings

ASTM D 3034 (1994) Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

ASTM D 3212 (1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

ASTM F 405 (1993) Corrugated Polyethylene (PE) Tubing and Fittings

ASTM F 667 (1985) Large Diameter Corrugated Polyethylene Tubing and Fittings

ASTM F 758 (1993) Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage

ASTM F 949 (1993) Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe Wit a Smooth Interior and Fittings

KENTUCKY DEPARTMENT OF HIGHWAYS (KDOH)

KDOH (1998) Standard Specifications for Road and Bridge Construction

1.2 SUBMITTALS

Government approval is required for submittals with a “GA” designation; submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-13 Certificates

Materials; GA.

Certifications from the manufacturers attesting that materials meet specification requirements.

SD-14 Samples

Materials; FIO.

Two (2) randomly selected samples of each type of pipe and fitting, prior to delivery of materials to the site.

1.3 DELIVERY, STORAGE AND HANDLING

Materials placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Plastic pipe shall not be exposed to direct sunlight for more than six (6) months from time of manufacturer to installation.

PART 2 PRODUCTS

2.1 MATERIALS

Pipe for foundation drainage system shall be of the type and size indicated. Appropriate transitions, adapters, or joint details must be used where pipes of different types or materials are connected.

2.1.1 thru 2.1.12 Not Used

2.1.13 Plastic Pipe

Plastic pipe shall contain ultraviolet inhibitor to provide protection from exposure to direct sunlight.

2.1.13.1 Corrugated Polyethylene (PE) Drainage Pipe

AASHTO M 252 for pipe 80 to 250mm in diameter. Fittings shall be pipe manufacturer's standard type and shall conform to the indicated specification.

2.1.13.2 Acrylonitrile-Butadiene-Styrene (ABS) Pipe

ASTM D 2751, with a maximum SDR of 35.

2.1.13.3 Polyvinyl Chloride (PVC) Pipe

ASTM F 758, Type PS 46, ASTM D 3034, or ASTM F 949 with a minimum pipe stiffness of 317 MPa.

2.1.13.4 Circular Perforations in Plastic Pipe

Circular holes shall be cleanly cut, not more than 7.9mm or less than 4.8mm in diameter, and arranged in rows parallel to the longitudinal axis of the pipe. Perforations shall be approximately 76.2mm apart, center-to-center, along rows. The rows shall be approximately 38.1mm apart and arranged in a staggered pattern so that all perforations lie at the midpoint between perforations in adjacent rows. The rows shall be spaced over not more than 155 degrees of circumference. The spigot or tongue end of the pipe shall not be perforated for a length equal to the depth of the socket and perforations shall continue at uniform spacing over the entire length of the pipe. Manufacturer's standard perforated pipe which essentially meets these requirements may be used with prior approval of the Contracting Officer.

2.1.13.5 Slotted Perforations in Plastic Pipe

Circumferential slots shall be cleanly cut so as not to restrict the inflow of water and uniformly spaced along the length and circumference of the tubing. Width of slots shall not exceed 3.2mm or be less than 0.79mm. The length of individual slots shall not exceed 31.8mm on 75mm diameter tubing; 10 percent of the tubing inside nominal circumference on 100 to 200mm diameter tubing; and 65mm on 300mm diameter tubing. Rows of slots shall be symmetrically spaces so that they are fully contained in quadrants of the pipe. Slots shall be centered in the valleys of the corrugations of profile wall pipe. The water inlet area shall be a minimum of 1058 square mm

per linear meter of tubing. Manufacturer's standard perforated pipe which essentially meets these requirements may be used with prior approval of the Contracting Officer.

2.1.14 Fittings

Fittings shall be of compatible materials for pipe, of corresponding weight and quality, and as specified herein.

2.1.15 Cleanouts and Piping Through Walls

Cleanout pipe and fittings and piping through walls and footings shall be cast-iron soil pipe. Each cleanout shall have a brass ferrule and a cast-brass screw-jointed plug with socket or raised head for wrench.

2.1.16 Not Used

2.1.17 Bedding and Previous Backfill for Foundation Drains

Bedding and pervious backfill shall be in accordance with KDOH, Section 805 No. 57s.

2.1.18 Protective Covering for Pervious Backfill

Protective covering shall be filter fabric conforming to Section 02710 SUBDRAINAGE SYSTEM.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

3.1.1 Extent

Foundation drainage shall be furnished and installed as a complete system as shown.

3.1.2 Outlet Connections

Foundation pipe shall be connected to the storm drainage system.

3.1.3 Drainage lines shall be constructed of perforated pipe.

3.1.4 Outlet Lines

Outlet lines shall be constructed of closed-joint nonperforated pipe.

3.2 INSTALLATION

3.2.1 Trenching and Excavation

Required trenching and excavation shall be in accordance with Section 02221 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS and Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Trenches shall be kept dry during installation of drainage system. Changes in direction of drain lines shall be made with 1/8 bends. Wye fittings shall be used at intersections.

3.2.2 Bedding

Graded bedding, a minimum of 150mm in depth, shall be placed in the bottom of trench for its full width and length and compacted as specified prior to laying of foundation drain pipe. Each section shall rest firmly upon the

bedding, through the entire length, with recesses formed for bell joints. Except for recesses for bell joints, the bedding shall fully support the lower quadrant of the pipe.

3.2.3 Pipe Laying

Drain lines shall be laid to true grades and alignment with a continuous fall in the direction of flow. Bells of pipe sections shall face upgrade. Interior of pipe shall be cleaned thoroughly before being laid. When drain lines are left open for connection to discharge lines, the open ends shall be temporarily closed and the location marked with wooden stakes. Perforated pipe shall be laid with perforations facing down. Any length that has had its grade or joints disturbed shall be removed and relaid at no additional cost to the Government. Perforated corrugated polyethylene drainage tubing and plastic piping shall be installed in accordance with manufacturer's specifications and as specified herein. Tubing and piping with physical imperfections shall not be installed.

3.2.4 Jointing

3.2.4.1 Perforated and Porous Pipes

Perforated types of drain pipes shall be laid with closed joints.

3.2.4.2 thru 3.2.4.7 Not Used

3.2.4.8 ABS Pipe

ABS pipe shall be joined using solvent cement or elastomeric joints and shall be in accordance with ASTM D 2751, with dimensions and tolerances in accordance with TABLE II therein.

3.2.4.9 PVC Pipe

PVC pipe joints shall be in accordance with ASTM D 3034, ASTM D 3212, or ASTM F 949.

3.2.4.10 Corrugated Polyetheylene

Corrugated Polyethelyne (PE) pipe joints shall be in accordance with ASTM F 405 or ASTM F 667.

3.2.5 Not Used

3.2.6 Backfilling

After joints and connections have been inspected and approved, the specified pervious backfill material shall be placed a minimum of 150mm on each side of the pipe for the full width of the trench and full width between pipe and adjacent walls and 300mm above the top of the pipe. When placing the backfill, care shall be taken to prevent displacement of or injury to the pipe or tile. A protective covering, as specified, shall be placed over the pervious backfill for the full width of the trench before regular backfill is placed. Backfill shall be compacted as specified in Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

3.2.7 Cleanouts

Cleanouts shall be provided in locations indicated. Cleanouts in unpaved areas shall be sent in 305 by 305 by 102mm concrete blocks.

--End of Section--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION DISCOM PROJECT - PHASE I/IIA, FORT CAMPBELL, KENTUCKY				CONTRACTOR										SPEC. SECTION 02711
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-13 Certificates										
		1	Materials; GA.										
			SD-14 Samples										
		2	Materials; FIO.										

SAFETY PAYS

SECTION 02714

DRAINAGE LAYER
12/97

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SAFETY PAYS

SECTION 02714

DRAINAGE LAYER
12/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29	(1991a) Unit Weight and Voids in Aggregate
ASTM C 88	(1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 127	(1998; R 1993) Specific Gravity and Absorption of Course Aggregate
ASTM C 128	(1993) Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1992) Sampling Aggregates
ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft - lbf/cu.ft. (2,700 kN-m/cu.m))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock In Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4791	(1995) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregates

ASTM E 11 (1995) Wire-Cloth Sieves for Testing Purposes

ASTM E 548 (1994) General Criteria Used for Evaluating Laboratory Competence

KENTUCKY DEPARTMENT OF HIGHWAYS (KDOH)

KDOH (1998) Standard Specifications for Road and Bridge Construction

1.2 SYSTEM DESCRIPTION

The Contractor shall build a drainage layer under the pavements as indicated and in accordance with the following subparagraphs:

1.2.1 Aggregate Drainage Layer

A drainage layer consisting of open grade materials stabilized with choke stone meeting the gradations specified in para 2.1.1. The work shall be performed in accordance with this specification and shall conform to the lines, grades, notes and typical sections shown in the plans. Sources of all materials shall be selected well in advance of the time that materials will be required in the work. Aggregate drainage layer as used herein is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Plant, Equipment, Machines, and Tools; FIO.

List of proposed equipment to be used in performance of construction work including descriptive data.

Plan Grade Spreadsheet; GA.

Contractor furnished spreadsheet shall provide all information required to determine conformance with grade requirements. The submittal must contain sufficient information in the format presented to determine if the spreadsheet will be acceptable. The spreadsheet should be adaptable to changing elevations as the project progresses through the subgrade up through and including the final surfacing. The tolerances should be readily identifiable and any nonconforming areas highlighted.

SD-09 Reports

Sampling and Testing; FIO.

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results for approval not less than 90 days before material is required for the work.

Evaluation; GA.

SAFETY PAYS

Test section construction report.

SD-18 Records

Coarse Aggregate; GA.

A notification stating which source of coarse aggregate is to be used following results of testing source.

1.4 FIELD COMPACTION

Field compaction requirements shall be based on the results of a test section constructed by the Contractor, using the materials, methods, and equipment proposed for use in the work. The test section shall meet the requirements of paragraph TEST SECTION.

1.5 PLANT, EQUIPMENT, MACHINES AND TOOLS

1.5.1 General Requirements

Plant, equipment, machines and tools used in the work shall be subject to approval and shall be maintained in satisfactory working condition at all times. Other compacting equipment may be used in lieu of that specified, where it can be demonstrated that the results are equivalent. The equipment shall be adequate and have the capability of producing the results specified.

1.5.2 Steel-Wheeled Rollers

Steel-wheeled rollers shall be the self-propelled type weighing not less than 9 metric tons, with a minimum weight of 135 kilograms per millimeter width of rear wheel. Wheels of the rollers shall be equipped with adjustable scrapers. The use of vibratory rollers is mandatory.

1.5.3 Mechanical Spreader

Mechanical spreader shall be self-propelled or attached to a propelling unit capable of moving the spreader and material truck. The device shall be steerable and shall have a variable speeds forward and reverse. The spreader and propelling unit shall be carried on tracks, rubber tires, or drum-type steel rollers that will not disturb the underlying material. The spreader shall contain a hopper, an adjustable screed, and outboard bumper rolls and be designed to have a uniform, steady flow of material from the hopper. The spreader shall be capable of laying material without segregation across the full width of the lane to a uniform thickness and to a uniform loose density so that when compacted, the layer or layers shall conform to thickness and grade requirements indicated. The Contracting Officer may require a demonstration of the spreader prior to approving use in performance of the work.

1.5.4 Sprinkling Equipment

Sprinkling equipment shall consist of tank trucks, pressure distributors or other approved equipment designed to apply controlled quantities of water uniformly over variable widths of surface.

1.5.5 Tampers

Tampers shall be of an approved mechanical type, operated by either pneumatic pressure or internal combustion, and shall have sufficient weight and striking power to produce the compaction required.

1.5.6 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one (1) 3.66 meter straightedge for each bituminous paver, for use in the testing of the finished surface. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to ensure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.6 WEATHER LIMITATION

Drainage layer material shall be placed when the atmospheric temperature is above 2 C.

1.7 SAMPLING AND TESTING

1.7.1 General Requirements

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory, or by the Contractor subject to approval. If the Contractor elects to establish testing facilities of his own, approval of such facilities shall be based on compliance with ASTM E 548, and no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved. The first inspection of the facilities will be at the expense of the Government and any subsequent inspections required because of failure of the first inspection shall be at the expense of the Contractor. Such costs will be deducted from the total amount due the Contractor. Drainage layer materials shall be tested to establish compliance with the specified requirements.

1.7.2 Sampling

Aggregate samples shall be taken in accordance with ASTM D 75.

1.7.3 Test Methods

1.7.3.1 Sieve Analyses

Sieve analyses shall be made in accordance with ASTM C 117 and ASTM C 136.

1.7.3.2 Density Tests

Field density tests shall be made in accordance with ASTM D 2922. When using this method, ASTM D 3017 shall be used to determine the moisture content of the aggregate drainage layer material. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph "Calibration" of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed by the Contracting Officer.

1.7.3.3 Soundness Test

Soundness tests shall be made in accordance with ASTM C 88.

1.7.3.4 Los Angeles Abrasion Test

Los Angeles abrasion tests shall be made in accordance with ASTM C 131.

1.7.3.5 Flat or Elongated Particles Tests

Flat and/or elongated particles tests shall be made in accordance with ASTM D 4791.

1.7.3.6 Fractured Faces Tests

When aggregates are supplied from crushed gravel, approved test methods shall be used to assure the aggregate meets the requirements for fractured faces in paragraph AGGREGATES.

1.7.4 Testing Frequency

1.7.4.1 Aggregate Layer

Sieve analyses, field density, and moisture content tests shall be performed at a rate of at least one test for every 1000 square meters of completed area and not less than one test for each day's production. Soundness tests, Los Angeles abrasion tests, fractured faces tests and flat and/or elongated particles tests shall be performed at the rate of one test for every 10 sieve analysis tests.

1.7.5 Approval of Materials

1.7.5.1 Aggregate

The aggregate source shall be selected at least 90 days prior to field use in the test section. Tentative approval of the source will be based on certified test results to verify that materials proposed for use meet the contract requirements. Final approval of both the source and the material will be based on test section performance and tests for gradation, soundness, Los Angeles abrasion, flat and/or elongated particles tests and fractured faces tests. For aggregate drainage layer materials, these tests shall be performed on samples taken from the completed and compacted drainage layer course within the test section. For bituminous or cement stabilized drainage layer material, these tests shall be performed on aggregate samples taken prior to addition of bituminous or cementitious material and subsequent placement in the test section.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aggregates

KY No. 57 Stone shall consist of crushed stone or slag, crushed gravel, angular sand, or other approved material. Aggregates shall be durable and sound, free from lumps of clay, organic matter, objectionable coatings, and other foreign material. Aggregate shall conform to the requirements of KDOH Section 805 for No. 57s for base course and No. 11s for choker course.

2.1.1.1 Coarse Aggregate

Only one type of coarse aggregate shall be used on the project. Coarse aggregates, consisting of angular fragments of uniform density and quality, shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested in accordance with ASTM C 131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3, and an elongated particle is one having a ratio of length to width greater than 3.

a. **Crushed Gravel:** Crushed gravel shall be manufactured from gravel particles 50 percent of which by weight are retained on the maximum size gradation sieve specified.

b. **Crushed Stone:** Crushed stone retained on each sieve specified shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are adjacent, the angle between the planes of the fractures must be at least 30 degrees to count as two fractured faces.

2.1.2 Aggregate Quality

The aggregate shall have a soundness loss not greater than 18 percent weighted averaged at five cycles when tested in magnesium sulfate in accordance with ASTM C 88. The aggregate shall have a percentage of loss on abrasion not to exceed 40 after 500 revolutions as determined by ASTM C 131. The percentage of flat and/or elongated particles shall be determined by ASTM D 4791 with the following modifications. The aggregates shall be separated into two size fractions. Particles greater than 12.5mm sieve and particles passing the 12.5mm sieve and retained on the 4.75mm. The percentage of flat and/or elongated particles in either fraction shall not exceed 20. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. When the aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements. When the aggregate is supplied from crushed gravel it shall be manufactured from gravel particles, 90 percent of which by weight are retained on the maximum-size sieve listed in TABLE I. In the portion retained on each sieve specified, the crushed gravel shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the face. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two (2) fractured faces.

2.1.3 Gradation

Requirements for gradation specified shall apply to the completed base course and shall meet the requirements of KDOH Section 805 for No. 57s and No. 11s.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the base is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 PREPARATION OF UNDERLYING COURSE

3.2.1 General Requirements

Before constructing aggregate base course, the previously constructed underlying course shall be cleaned of all foreign substances. Surface of underlying course shall meet the specified compaction and surface tolerances. Subgrade shall conform to Section 02225 EARTHWORK FOR ROADWAYS, PARKING LOTS AND HARDSTANDS. Subbase course shall conform to Section 02721 SUBBASE COURSES. Ruts or soft yielding spots that may appear in the underlying course, areas having inadequate compaction and deviations of the surface from the requirements specified shall be corrected. For cohesionless underlying materials containing sands, sand gravels, or any other cohesionless material in harmful quantities, the surface shall be mechanically stabilized with aggregate prior to placement of the aggregate course. Stabilization may be accomplished by mixing base course material into the underlying course and compacting by approved methods. Properly compacted material will be considered as part of the underlying course and shall meet all requirements for the underlying course. Finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until base course is placed.

3.3 TEST SECTION

3.3.1 General

3.3.2 Scheduling

The test section shall be constructed a minimum of 30 days prior to the start of full scale production to provide sufficient time for an evaluation of the proposed materials, equipment and procedures including Government QA testing.

3.3.3 Location and Size

The test section shall be placed outside the production paving limits in an area with similar subgrade and subbase conditions approved by the Contracting Officer. The underlying courses and subgrade preparation, required for the pavement section, shall be completed, inspected and approved in the test section prior to constructing the drainage layer. The test section shall be a minimum of 30m long and one full paving lane wide.

3.3.4 Initial Testing

Certified test results, to verify that the materials proposed for use in the test section meet the contract requirements, shall be provided by the Contractor and approved by the Contracting Officer prior to the start of the test section.

3.3.5 Mixing, Placement, and Compaction

Mixing, placement, and compaction shall be accomplished using equipment meeting the requirements of paragraph EQUIPMENT. Compaction equipment speed shall be no greater than 2.4 km/hour. 1.5 miles per hour.

3.4 INSTALLATION

3.4.1 Placing

Materials shall be mixed by the stationary plant, traveling plant, or road mix method and placed in such a manner as to obtain uniformity of the aggregate base course material and at a uniform optimum water content for compaction. The Contractor shall make such adjustments in mixing or placing procedures or in equipment to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to ensure a satisfactory base course.

3.4.2 Edges of Base Course

Approved material shall be placed along edges of aggregate base course in such quantities as will compact to thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 300mm width of the shoulder to be rolled and compacted simultaneously with rolling and compacting of each layer of base course.

3.4.3 Compaction

Each layer of aggregate base course including shoulders shall be compacted. Compaction effort shall be six (6) passes of a nine (9) metric tone vibratory roller. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. Areas inaccessible to the rollers shall be compacted with mechanical tampers, and shall be shaped and finished by hand methods. A choker course shall be placed after the final lift and compacted to provide a stable and uniformly dense surface for paving.

3.4.4 Layer Thickness

Compacted thickness of the aggregate course shall be as indicated. No layer shall be in excess of 150mm nor less than 75mm in compacted thickness

3.4.5 Not Used

3.4.6 Not Used

3.4.7 Smoothness

Surface of each layer shall show no deviations in excess of 9.5mm when tested with the 3.66 meter straightedge. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting, as directed.

3.4.8 Thickness Control

Compacted thickness of the base course shall be within 12.7mm of the thickness indicated. Where the measured thickness is more than 12.7mm deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 12.7mm thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 7mm of the thickness indicated.

3.4.9 Hand Spreading

In areas where machine spreading is impractical, drainage layer material shall be spread by hand. The material shall be spread by hand. The material shall be spread uniformly in a loose layer so as to prevent segregation along with conforming to the required grade and thickness after compaction.

3.5 FIELD QUALITY CONTROL

3.5.1 Not Used

3.5.2 Smoothness

Measurements for deviation from grade and cross section shown shall be taken in successive positions parallel to the road centerline with a 3.66m straightedge. Measurements shall also be taken perpendicular to the road centerline at 15m intervals.

3.5.3 Thickness

Thickness of the base course shall be measured at intervals in such a manner as to ensure one measurement for each 500 square meters of base course. Measurements shall be made in 75mm diameter test holes penetrating the base course.

3.5.4 Edges of Drainage Layer

Shoulder material shall be placed along the edges of the drainage layer course in a quantity that will compact to the thickness of the layer being constructed. When the drainage layer is being constructed in two (2) or more lifts, at least a 300mm width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each lift of the drainage layer.

3.6 TRAFFIC

Completed portions of the area will not be opened to traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

3.7 MAINTENANCE

The aggregate base course shall be maintained in a satisfactory condition until accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact.

3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Removed in-place materials that are unsuitable for the base course material that is removed for the required correction of defective areas, and waste material and debris shall be disposed of in waste disposal areas indicated.

--End of Section--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION DISCOM PROJECT - PHASE I/IIA, FORT CAMPBELL, KENTUCKY				CONTRACTOR										SPEC. SECTION 02714
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ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			Para 1.3 SUBMITTALS										
			SD-01 Data										
		1	Plant, Equipment, Machines, and Tools; FIO.										
		2	Plan Grade Spreadsheet; GA.										
			SD-09 Reports										
		3	Sampling and Testing; FIO.										
		4	Evaluation; GA.										
			SD-18 Records										
		5	Coarse Aggregate; GA.										

SAFETY PAYS

SECTION 02720

STORM-DRAINAGE SYSTEM
06/91

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SAFETY PAYS

SECTION 02720

STORM-DRAINAGE SYSTEM
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 346/346R (1990) Standard Specification for Cast-in-Place Nonreinforced Concrete Pipe and Recommendations

AMERICAN RAILWAY ENGINEERING ASSOCIATION (AREA)

AREA-03 (1994) Manual for Railway Engineering (Fixed Properties): Chapter 1, Roadway and Ballast

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-16 (1996) Standard Specifications for Highway Bridges

AASHTO M 198 (1994) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

AASHTO M 294 (1994) Corrugated Polyethylene Pipe, 305- to 915- mm 12-to 36 in. Diameter

AASHTO M 304 Controlled (1994) Poly(Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Inside Diameter

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48 (1994a) Gray Iron Castings

ASTM A 123 (1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 536 (1984; R 1993) Ductile Iron Castings

ASTM C 14 (1995) Concrete Sewer, Storm Drain, and Culvert Pipe

ASTM C 32 (1993) Sewer and Manhole Brick (Made from Clay or Shale)

ASTM C 55 (1995) Concrete Building Brick

ASTM C 62 (1996) Building Brick (Solid Masonry Units Made from Clay or Shale)

ASTM C 76 (1995) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

ASTM C 139 (1995) Concrete Masonry Units for Construction of Catch Basins and Manholes

ASTM C 231	(1991b) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(1996a) Mortar for Unit Masonry
ASTM C 443	(1994) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 478	(1994) Precast Reinforced Concrete Manhole Sections
ASTM C 655	(1994) Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
ASTM C 789	(1994) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
ASTM C 850	(1994) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 Ft. of Cover Subjected to Highway Loadings
ASTM D 1056	(1991) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1171	(1994) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1784	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2321	(1989; R 1995) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3034	(1994) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3350	(1993) Polyethylene Plastics Pipe and Fittings Materials
ASTM F 477	(1995) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 679	(1995) Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F 714	(1994) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

ASTM F 794 (1995a) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

ASTM F 894 (1995) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe

ASTM F 949 (1994) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

KENTUCKY DEPARTMENT OF HIGHWAYS (KDOH)

KDOH (1998) Standard Specifications for Road and Bridge Construction

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Placing Pipe; FIO.

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

SD-13 Certificates

Resin Certification; FIO.

Pipeline Testing; FIO.

Hydrostatic Test on Watertight Joints; FIO.

Determination of Density; FIO.

Frame and Cover for Gratings; FIO.

Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed. Certification on the ability of frame and cover or gratings to carry the imposed live load.

SD-14 Samples

Pipe for Culverts and Storm Drains; FIO.

Samples of the following materials, before work is started: Gaskets.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and

debris. Gasket materials and plastic materials shall be protected from exposure to the direct sunlight over extended periods.

1.3.2 Handling

Materials shall be handled in such a manner as to ensure delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

ASTM C 76, Class III, IV, V, or ASTM C 655, 65 newtons per linear meter, D-Load.

2.1.1.1 Not Used

2.1.1.2 Not Used

2.1.1.3 Nonreinforced Pipe

ASTM C 14, Class 3.

2.1.2 Not Used

2.1.3 PVC Pipe

The pipe manufacturer's resin certification indicating the cell classification of PVC used to manufacture the pipe shall be submitted prior to installation of the pipe. PVC pipe will only be permitted in non traffic areas and shall not pass below any pavement including future construction that is shown on the drawings.

2.1.3.1 Type PSM PVC Pipe

ASTM D 3034, Type PSM, maximum SDR 35, produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.3.2 Profile PVC Pipe

ASTM F 794, Series 46, produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.3.3 Smooth Wall PVC Pipe

ASTM F 679 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.3.4 Corrugated PVC Pipe

ASTM F 949 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1794, minimum cell class 12454-B.

2.1.4 PE Pipe

The pipe manufacturer's resin certification indicating the cell classification of PE used to manufacture the pipe shall be submitted prior to installation of the pipe. The minimum cell classification for polyethylene plastic shall apply to each of the seven primary properties of the cell classification limits in accordance with ASTM D 3350. PE pipe will only be permitted in non traffic areas and shall not pass below any pavement including future construction that is shown on the drawings.

2.1.4.1 Smooth Wall PE Pipe

ASTM 714, maximum DR of 21 for pipes 80 to 600mm in diameter. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D 3350, minimum cell class 335434C.

2.1.4.2 Corrugated PE Pipe

AASHTO M 294, Type S, produced from PE certified by the resin producer as meeting the requirements of ASTM D 3350, minimum cell class 315412C or 324420C. Pipe walls shall have the following properties:

Nominal Size (mm)	Minimum Wall Area (square mm/n)	Minimum Moment of Inertia of Wall Section
300	3200	390
275	4000	870
450	4900	1020

2.1.4.3 Profile Wall PE Pipe

ASTM F 894, RSC 160, produced from PE certified by the resin producer as meeting the requirements of ASTM D 3350, minimum cell class 334433C. Pipe walls shall have the following properties:

Nominal Size (mm)	Minimum Wall Area (square mm/n)	Cell Class 334433C	Cell Class 335434C
450	6300	850	620

2.2 NOT USED

2.3 MISCELLANEOUS MATERIALS

2.3.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for KDOH Class A 25 MPa concrete under Section 601. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 37.5mm. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall not be less than 25mm thick for covers and not less than 40mm thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 75mm between steel and ground. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

2.3.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C 270, Type M, except the maximum placement time shall be one (1) hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed 17 liters of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be

used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.3.3 Precast Concrete Segmental Blocks

Precast concrete segmental block shall conform to ASTM C 139, not more than 200mm thick, not less than 200mm long, and of such shape that joints can be sealed effectively and bonded with cement mortar.

2.3.4 Not Used

2.3.5 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall conform to ASTM C 478. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure.

2.3.6 Not Used

2.3.7 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron, ASTM A 48, Class 35B; cast ductile iron, ASTM A 536, Grade 65-45-12; or cast aluminum, ASTM B 26, Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans or on KDOH Standard Drawings. Grates for manholes used as catch basins must have 0.19 square meter open area and a weight of at least 109 kg.

2.3.8 Joints

2.3.8.1 Flexible Watertight Joints

a. Materials: Flexible watertight joints shall be made with plastic or rubber-type gaskets for concrete pipe and with factory-fabricated resilient materials for clay pipe. The design of joints and the physical requirements for plastic gaskets shall conform to AASHTO M 198, and rubber-type gaskets shall conform to ASTM C 443. Factory-fabricated resilient joint materials shall conform to ASTM C 425. Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber-type gasket are permitted if the nominal diameter of the pipe being gasketed exceeds 1.35m.

b. Test Requirements: Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C 443. Certified copies of test results shall be delivered to the Contracting Officer before gaskets or jointing materials are installed. Alternate types of watertight joint may be furnished if specifically approved.

2.3.8.2 External Sealing Bands

Requirements for external sealing bands shall conform to ASTM C 877.

2.3.8.3 Flexible Watertight, Gasketed Joints

a. Gaskets: When infiltration or exfiltration is a concern for pipe lines, the couplings may be required to have gaskets. The closed-cell expanded rubber gaskets shall be a continuous band approximately 178mm wide and approximately 9.5mm thick, meeting the requirements of ASTM D 1056, Type 2 and shall have a quality retention rating of not less than 70 percent when tested for weather resistance by ozone chamber exposure, Method B of

ASTM D 1171. Rubber O-ring gaskets shall be 20.6mm in diameter for pipe diameters of 914 mm (36 inches) 36 inches or smaller and 22.2mm in diameter for larger pipe having 12.7mm deep end corrugation. Rubber O-ring gaskets shall be 34.9mm in diameter for pipe having 25mm deep end corrugations. O-rings shall meet the requirements of AASHTO M 198 or ASTM C 443. Flexible plastic gaskets shall conform to requirements of AASHTO M 198, Type B.

b. Connecting Bands: Connecting bands shall be of the type, size and sheet thickness of band, and the size of angles, bolts, rods and lugs as indicated or where not indicated as specified in the applicable standards or specifications for the pipe. Exterior rivet heads in the longitudinal seam under the connecting band shall be countersunk or the rivets shall be omitted and the seam welded. Watertight joints shall be tested and shall meet the test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS.

2.3.8.4 PVC Plastic Pipes

Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.

2.3.8.5 Smooth Wall PE Plastic Pipe

Pipe shall be joined using butt fusion method as recommended by the pipe manufacturer.

2.3.8.6 Corrugated PE Plastic Pipe

Water tight joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F 477. Soil tight joints shall conform to the requirements in AASHTO HB-16, Division II, Section 26.4.2.4. (e) for soil tightness and shall be as recommended by the pipe manufacturer.

2.3.8.7 Profile Wall PE Plastic Pipe

Joints shall be gasketed or thermal weld type with integral bell in accordance with ASTM F 894.

2.3.8.8 Not Used

2.3.8.9 Class III Channel Lining

Class III Channel Lining shall conform to KDOH 703.02.01.

2.4 MANHOLE/DRAINAGE STRUCTURE STEPS

Manhole/drainage structure steps shall be manufactured with 12.7mm D-formed grade 60 reinforcement with an interjection molded copolymer polypropylene plastic shell. Pullout strength of 680 kg and impact strength of 136 kg. Steps shall provide a positive friction lock after driving into preformed or predrilled holes. Steps shall be resistant to corrosive environments and shall have a continuous unbroken covering over the steel core. As an alternate provision, the Contractor shall supply steps meeting the requirements of KDOH Standard Drawing RDB-430-02.

2.5 DOWNSPOUT BOOTS

Boots used to connect exterior downspouts to the storm-drainage system shall be of gray cast iron conforming to ASTM A 48, Class 30B or 35B. Shape and size shall be as indicated.

2.6 HYDROSTATIC TEST ON WATERTIGHT JOINTS

2.6.1 Concrete, PVC and PE Pipe

A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Performance requirements for joints in reinforced and nonreinforced concrete pipe shall conform to AASHTO M 198 or ASTM C 443. Test requirements for joints in clay pipe shall conform to ASTM C 425. Test requirements for joints in PVC and PE plastic pipe shall conform to ASTM D 3212.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches and for appurtenances and backfilling for culverts and storm drains shall be in accordance with the applicable portions of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS and Section 02225 EARTHWORK FOR ROADWAYS, RAILROADS, PARKING LOTS AND HARDSTANDS and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 300mm to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing where required shall be placed within the trench width as specified. Care shall be taken not to overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures shall be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 200mm or 85mm for each meter foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor in his performance of shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe

When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded carefully in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or pipe arch. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be only of such length, depth, and width as required for properly making the particular type of joint.

3.2.2 Not Used

3.2.3 Not Used

3.2.4 Not Used

3.2.5 Plastic Pipe

Bedding for PVC and PE pipe shall meet the requirements of ASTM D 2321. Bedding, haunching, and initial backfill shall be either Class IB or II material.

3.3 PLACING PIPE

Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to the direct sunlight prior to laying as needed to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed plastic pipe shall not exceed 4.5 percent of the nominal inside diameter. After backfilling has been completed, the Government may perform a deflection test on the entire length of installed plastic pipeline using a mandrel or other suitable device. Any plastic pipe showing deflections in excess of 4.5 percent shall be removed and replaced at the Contractor's expense. All pipe in place shall be inspected before backfilling, and those pipes damaged during placement shall be removed and replaced.

3.3.1 Concrete, PVC, and Ribbed PVC and Ductile Iron Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.3.2 Not Used

3.3.3 Corrugated PE Pipe

Laying shall be with the separate sections joined firmly on a bed shaped to line and grade and shall follow manufacturer's recommendations.

3.3.4 Jacking Pipe Through Fills

Methods of operation and installation for jacking pipe through fills shall conform to requirements specified in Vol I, Chapter 8 of AREA-03.

3.4 JOINTS

3.4.1 Concrete

3.4.1.1 Cement-Mortar Bell-and-Spigot Joint

The first pipe shall be bedded to the established gradeline, with the bell end placed upstream. The interior surface of the bell shall be carefully cleaned with a wet brush and the lower portion of the bell filled with mortar to such depth as to bring inner surfaces of abutting pipes flush and even. The spigot end of each subsequent pipe shall be cleaned with a wet brush and uniformly matched into a bell so that sections are closely fitted. After each section is laid, the remainder of the joint shall be filled with mortar, and a bead shall be formed around the outside of the joint with sufficient additional mortar. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint shall be wrapped or bandaged with cheesecloth to hold mortar in place.

3.4.1.2 Cement-Mortar Oakum Joint for Bell-and-Spigot Pipe

A closely twisted gasket shall be made of jute or oakum of the diameter required to support the spigot end of the pipe at the proper grade and to make the joint concentric. Joint packing shall be in one piece of sufficient length to pass around the pipe and lap at top. This gasket shall be thoroughly saturated with neat cement grout. The bell of the pipe shall be thoroughly cleaned with a wet brush, and the gasket shall be laid in the bell for the lower third of the circumference and covered with mortar. The spigot of the pipe shall be thoroughly cleaned with a wet brush, inserted in the bell, and carefully driven home. A small amount of mortar shall be inserted in the annular space for the upper two-thirds of the circumference. The gasket then shall be lapped at the top of the pipe and driven home in the annular space with a caulking tool. The remainder of the annular space then shall be filled completely with mortar and beveled at an angle of approximately 45 degrees with the outside of the bell. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint thus made shall be wrapped with cheesecloth. Placing of this type of joint shall be kept at least five joints behind laying operations.

3.4.1.3 Cement-Mortar Diaper Joint for Bell-and-Spigot Pipe

The pipe shall be centered so that the annular space is uniform. The annular space shall be caulked with jute or oakum. Before caulking, the inside of the bell and the outside of the spigot shall be cleaned.

a. Diaper Bands: Diaper bands shall consist of heavy cloth fabric to hold grout in place at joints and shall be cut in such lengths that they will extend one-eighth of the circumference of pipe above the spring line on one side of the pipe and up to the spring line on the other side of the pipe. Longitudinal edges of fabric bands shall be rolled and stitched around two pieces of wire. Width of fabric bands shall be such that after fabric has been securely stitched around both edges on wires, the wires will be uniformly spaced not less than 200 mm 8 inches apart. Wires shall be cut into lengths to pass around pipe with sufficient extra length for the ends to be twisted at top of pipe to hold the band securely in place; bands shall be accurately centered around lower portion of joint.

b. Grout: Grout shall be poured between band and pipe from only the high side of band, until grout rises to the top of band at the spring line of pipe, or as nearly so as possible, on the opposite side of pipe, to ensure a thorough sealing of joint around the portion of pipe covered by the band. Silt, slush, water, or polluted mortar grout forced up on the lower side shall be carefully forced out by pouring and removed.

c. Remainder of Joint: The remaining unfilled upper portion of the joint shall then be filled with mortar and a bead formed around the outside of this upper portion of the joint with a sufficient amount of additional mortar. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind actual laying of pipe. No backfilling around joints shall be done until joints have been fully inspected and approved.

3.4.1.4 Cement-Mortar Tongue-and-Groove Joint

The first pipe shall be bedded carefully to the established gradeline with the groove upstream. A shallow excavation shall be made underneath the pipe at the joint and filled with mortar to provide a bed for the pipe. The grooved end of the first pipe shall be carefully cleaned with a wet brush, and a layer of soft mortar applied to the lower half of the groove. The tongue of the second pipe shall be cleaned carefully with a wet brush; while in horizontal position, a layer of soft mortar shall be applied to the upper half of the tongue. The tongue end of the second pipe then shall be inserted in the grooved end of the first pipe until mortar is squeezed out on interior and exterior surfaces. Sufficient mortar shall be used to fill the joint completely and to form a bead on the outside.

3.4.1.5 Cement-Mortar Diaper Joint for Tongue-and-Groove Pipe

The joint shall be of the type described for cement-mortar tongue-and-groove joint in this paragraph, except that the shallow excavation directly beneath the joint shall not be filled with mortar until after a gauze or cheesecloth band dipped in cement mortar has been wrapped around the outside of the joint. The cement-mortar bead at the joint shall be at least 15mm, thick and the width of the diaper band shall be at least 200 mm. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind the actual laying of the pipe. No backfilling around the joints shall be done until the joints have been fully inspected and approved.

3.4.1.6 Plastic Sealing Compound Joints for Tongue-and-Grooved Pipe

Sealing compounds shall follow the recommendation of the particular manufacturer in regard to special installation requirements. Surfaces to receive lubricants, primers, or adhesives shall be dry and clean. Sealing compounds shall be affixed to the pipe not more than 3 hours prior to installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Sealing compounds shall be inspected before installation of the pipe, and any loose or improperly affixed sealing compound shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making the joint with mastic-type sealant, a slight protrusion of the material is not visible along the entire inner and outer circumference of the joint when the joint is pulled up, the pipe shall be removed and the joint remade. After the joint is made, all inner protrusions will be cut off flush with the inner surface of the pipe. If nonmastic-type sealant material is used, the "Squeeze-Out" requirement above shall be waived.

3.4.1.7 Flexible Watertight Joints

Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.

3.4.1.8 External Sealing Band Joint for Noncircular Pipe

Surfaces to receive sealing bands shall be dry and clean. Bands shall be installed in accordance with manufacturer's recommendations.

3.4.2 Corrugated Metal Pipe

3.4.2.1 Field Joints

Transverse field joints shall be of such design that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A 798. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. The annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 750mm or larger, shall be filled with a bituminous material after jointing. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.

3.4.2.2 Flexible Watertight, Gasketed Joints

Installation shall be as recommended by the gasket manufacturer for use of lubricants and cements and other special installation requirements. The gasket shall be placed over one end of a section of pipe for half the width of the gasket. The other half shall be doubled over the end of the same pipe. When the adjoining section of pipe is in place, the doubled-over half of the gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so that the gasket covers the end of pipe sections equally. Connecting bands shall then be centered over adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. Band Tightening: The band shall be tightened evenly, even tension being kept on the rods or bolts, and the gasket shall be closely observed to see that it is seating properly in the corrugations. Watertight joints shall remain uncovered for a period of time designated, and before being covered, tightness of the nuts shall be measured with a torque wrench. If the nut has tended to loosen its grip on the bolts or rods, the nut shall be retightened with a torque wrench and remain uncovered until a tight, permanent joint is assured.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete, plain concrete, precast reinforced concrete, precast concrete segmental blocks, complete with frames and covers or gratings and with fixed steps where indicated.

3.5.2 Walls and Headwalls

Construction shall be as indicated.

3.6 NOT USED

3.7 BACKFILLING

3.7.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 150mm in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. Care shall be taken

to ensure thorough compaction of the fill under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 300mm above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 150mm. Tests for density will be made as necessary to ensure conformance to the compaction requirements specified elsewhere in this paragraph. Where it is necessary in the opinion of the Contracting Officer, any sheeting or portions of bracing used shall be left in place and the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.7.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified elsewhere in this paragraph. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 150mm in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 300mm above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 4m, whichever is less. After the backfill has reached at least 300mm above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 150mm.

3.7.3 Movement of Construction Machinery

In compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.7.4 Compaction

3.7.4.1 General

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.7.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density (densities) which will be determined as specified in this paragraph.

a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.

b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.

c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.7.5 Determination of Density

Testing shall be the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2167 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017 or ASTM D 2922. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.8 PIPELINE TESTING

Lines shall be tested for leakage by exfiltration tests. Prior to testing for leakage the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 600mm or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 600mm is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be reestablished. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by the exfiltration test shall not exceed 23.2 liters per mm in diameter per kilometer in diameter per mile of pipeline per day. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correcting, and retesting shall be made at no additional cost to the Government.

--End of Section--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION DISCOM PROJECT - PHASE I/II, FORT CAMPBELL, KENTUCKY				CONTRACTOR									SPEC. SECTION 02720	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-06 Instructions										
		1	Placing Pipe; FIO.										
			SD-13 Certificates										
		2	Resin Certification; FIO.										
		3	Pipeline Testing; FIO.										
		4	Hydrostatic Test on Watertight Joints; FIO.										
		5	Determination of Density; FIO.										
		6	Frame and Cover for Gratings; FIO.										
			SD-14 Samples										
		7	Pipe for Culverts and Storm Drains; FIO.										

SAFETY PAYS

SECTION 02721

SUBBASE COURSES
03/97

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End of Section 02721-5

SAFETY PAYS

SECTION 02721

SUBBASE COURSES
03/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29 (1991a) Unit Weight and Voids in Aggregate

ASTM C 117 (1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C 131 (1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C 136 (1995a) Sieve Analysis of Fine and Coarse Aggregates

ASTM D 75 (1987; R 1992) Sampling Aggregates

ASTM D 1556 (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557 (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))

ASTM D 2167 (1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method

ASTM D 2487 (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 2922 (1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 3017 (1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

ASTM D 4318 (1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM E 11 (1995) Wire-Cloth Sieves for Testing Purposes

KENTUCKY DEPARTMENT OF HIGHWAYS (KDOH)

KDOH (1998) Standard Specifications for Road and Bridge Construction

1.2 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, Method C&D. This will be abbreviated herein after as percentage of laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment; FIO.

List of proposed equipment to be used in performance of construction work, including descriptive data.

Plan Grade Spreadsheet; GA.

Contractor furnished spreadsheet shall provide all information required to determine conformance with grade requirements. The submittal must contain sufficient information in the format presented to determine if it will be acceptable. The spreadsheet should be adaptable to changing elevations as the project progresses through the subgrade up through and including the final surfacing. The tolerances should be readily identifiable and any nonconforming areas highlighted.

SD-09 Reports

Sampling and Testing; FIO.

Copies of test results.

SD-18 Records

Coarse Aggregate Source; GA.

A notification stating which source of Course Aggregate is to be used following approval of sample and test results.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved testing laboratory in accordance with Section 01440 CONTRACTOR QUALITY CONTROL. Tests shall be performed at the specified frequency. No work requiring testing will be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11.

1.4.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.4.2.3 Density Tests

Density shall be field measured in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. For the method presented in ASTM D 1556 the base plate as shown in the drawing shall be used. For the method presented in ASTM D 2922 the calibration curves shall be checked, and adjusted if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and, when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration, in ASTM D 2922, on each different type of material to be tested at the beginning of a job and at intervals as directed.

1.4.2.5 Wear Test

Wear tests shall be made on subbase course material in conformance with ASTM C 131.

1.4.3 Approval of Material

The source of the material shall be selected 90 days prior to the time the material will be required in the work. Approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted subbase course.

1.5 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 2°C. When the temperature falls below 2°C, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 EQUIPMENT

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 MATERIALS

KY DGA shall consist of crushed stone or gravel or other sound, durable, approved materials processed and blended or naturally combined. Aggregates shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. Material retained on the No. 4 sieve shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested as specified in ASTM C 131. Aggregate shall be reasonably uniform in density and quality. Aggregates shall have a maximum size of 25mm and shall be within the limits specified in KDOH Section 805 for DGA. The portion of any blended component and of the completed course passing the No. 40 sieve shall be either nonplastic or shall have a liquid limit not greater than 25 and a plasticity index not greater than five (5).

PART 3 EXECUTION

3.1 NOT USED

3.2 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.3 PREPARATION OF UNDERLYING MATERIAL

Prior to constructing the subbase course, the underlying course or subgrade shall be cleaned of all foreign substances. Subgrade shall conform to the requirements of Section 02225 EARTHWORK FOR ROADWAYS, PARKING LOTS AND HARDSTANDS. Ruts, or soft yielding spots, in the underlying courses, subgrade areas having inadequate compaction, and deviations of the surface from the specified requirements, shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the subbase course. Stabilization shall be accomplished by mixing subbase-course material into the underlying course, and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements for the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the subbase course is placed.

3.4 GRADE CONTROL

The finished and completed subbase course shall conform to the lines, grades, and contours shown. The lines, grades, and contours shown shall be maintained by means of line and grade stakes placed by the Contractor at the site of work. All layout, staking and grade control surveying shall be under the direct supervision of a registered land surveyor who shall be responsible for the entire project. All grade control including horizontal location for roads and parking lots shall be laid out and checked by the surveyor. The surveyor shall ensure that all grade tolerances stated in the specifications and shwon on the drawings are met. The Contractor shall develop a “Plan Grade” spreadsheet for all paved areas that will be used to verify conformance with the contract requirements. During the progress of the paving operations the spreadsheet will be updated and the conformance verified with the requirements as listed herein.

3.5 MIXING AND PLACING MATERIALS

The materials shall be mixed and placed to obtain uniformity of the subbase material at the water content specified. The Contractor shall make such adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory subbase course.

3.6 LAYER THICKNESS

The compacted thickness of the completed course shall be as indicated. When a compacted layer of 150mm is specified, the material may be placed in a single layer; when a compacted thickness of more than 150mm is required, no layer shall exceed 150mm nor be less than 75 mm when compacted.

3.7 COMPACTION

Each layer of the subbase course shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus two (2) percent of optimum water content, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer is compacted through the full depth to at least 95 percent of laboratory maximum density. Density testing will be performed on each 500 square meters of completed subbase course placed. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory subbase course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.8 NOT USED

3.9 EDGES

Approved material shall be placed along the edges of the subbase course in such quantity as will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least a 300mm width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the subbase course, as directed.

3.10 SMOOTHNESS TEST

The surface of each layer shall not show deviations in excess of 9.5m when tested with a 3.05m straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by removing material, replacing with new material, or reworking existing material and compacting, as directed.

3.11 THICKNESS CONTROL

The completed thickness of the subbase course shall be in accordance with the thickness and grade indicated on the drawings. The thickness measurement shall be made by test holes, at least 75mm in diameter through the course. The completed subbase course shall not be more than 13mm deficient in thickness nor more than 13mm above or below the established grade. Where any of these tolerances are exceeded, the Contractor shall correct such areas by scarifying, adding new material of proper gradation or removing material, and compacting, as directed. Where the measured thickness of the subbase course is 13mm or more thicker than shown, the course will be considered as conforming with the specified thickness requirements plus 13mm. The average job thickness shall be the average of the job measurements as specified above but within 6mm of the thickness shown.

3.12 MAINTENANCE

The subbase course shall be maintained in a satisfactory condition until accepted.

-- End of Section--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION DISCOM PROJECT - PHASE I/IIA, FORT CAMPBELL, KENTUCKY				CONTRACTOR									SPEC. SECTION 02721	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-01 Data										
		1	Equipment; FIO.										
		2	Plan Grade Spreadsheet; GA.										
			SD-09 Reports										
		3	Sampling and Testing; FIO.										
			SD-18 Records										
		4	Coarse Aggregate Source; GA.										

***** SAFETY PAYS *****

SECTION 02730

SANITARY SEWERS
06/92

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***** SAFETY PAYS *****

SECTION 02730

SANITARY SEWERS
06/92

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

KENTUCKY DEPARTMENT OF HIGHWAYS (KDOH)

KDOH (1998) Kentucky Department of Highways Standard Specifications for Road and Bridge Construction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33 (1993) Concrete Aggregates

ASTM C 94 (1995) Ready-Mixed Concrete

ASTM C 150 (1995) Portland Cement

ASTM C 270 (1995a) Mortar for Unit Masonry

ASTM C 443 (1994) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

ASTM C 478 (1994) Precast Reinforced Concrete Manhole Sections

ASTM C 478M (1994) Precast Reinforced Concrete Manhole Sections (Metric)

ASTM C 828 (1990) Low-Pressure Air Test of Vitrified Clay Pipe Lines

ASTM C 924 (1989) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method

ASTM C 972 (1982; R 1990) Test Method for Compression-Recovery of Tape Sealant

ASTM D 412 (1992) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension

ASTM D 412 (1992) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension

ASTM D 624 (1991) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

ASTM D 412 (1992) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension

ASTM D 624 (1991) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

ASTM D 1784 (1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl
ASTM D 2680 (1995)Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping

ASTM D 2751 (1993) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings

ASTM D 3034 (1994) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

ASTM D 3212 (1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

ASTM F 402 (1993) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

ASTM F 794 (1995a) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

ASTM F 894 (1995) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe

ASTM F 949 (1993a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C110 (1993) Ductile-Iron and Gray-Iron Fittings, 3 (75 mm through 1200 mm).

1.2 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 1.5 m 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer. Force mains and inverted siphons are specified in Section 02732 FORCE MAINS AND INVERTED SIPHONS; SEWER. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Portland Cement; FIO.

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Not Used

2.1.2 Plastic Pipe

Polyvinyl chloride (PVC) composite sewer piping shall conform to ASTM D 2680. Size 200 mm through 380 mm diameter.

2.1.2.1 Not Used

2.1.2.2 PVC Pipe

ASTM D 3034, Type PSM with a maximum SDR of 35, Size 380 mm or less in diameter. ASTM F 949 for corrugated sewer pipes with a smooth interior. UBPPA UNI-B-9 and ASTM F 794, Series 46, for ribbed sewer pipe with smooth interior, size 200 mm through 1200 mm diameters. PVC shall be certified by the compounder as meeting the requirements of ASTM D 1784, cell Class 12454B. The pipe stiffness shall be greater than or equal to 735/D for cohesionless material pipe trench backfills.

2.1.3 Not Used

2.1.4 Not Used

2.1.5 Ductile Iron Pipe

Pipe shall conform to AWWA C151 unless otherwise shown or specified.

2.1.6 Not Used

2.2 FITTINGS

Fittings shall be compatible with the pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and other requirements specified below.

2.2.1 Not Used

2.2.2 Plastic Pipe

PVC composite sewer pipe fittings shall conform to ASTM D 2680.

2.2.2.1 Not Used

2.2.2.2 PVC Pipe

ASTM D 3034 for type PSM pipe. ASTM F 949 for corrugated sewer pipe with a smooth interior. UBPPA UNI-B-9 and ASTM F 794, Series 46, for ribbed sewer pipe with smooth interior.

2.2.2.3 High Density Polyethylene Pipe

ASTM F 894.

2.2.3 Not Used

2.2.4 Not Used

2.2.5 Ductile Iron Pipe

Mechanical fittings shall conform to AWWA C110, rated for 1.03 MPa. Push-on fittings shall conform to AWWA C110and AWWA C111, rated for 10.3 MPa.

2.3 JOINTS

Joints installation shall comply with the manufacturer's instructions. Fittings and gaskets utilized for waste drains or industrial waste lines shall be certified by the manufacturer as resistant.

2.3.1 Concrete Pipe

Joints and gaskets shall conform to ASTM C 443.

2.3.2 Plastic Pipe

Flexible plastic pipe (PVC or high density polyethylene pipe) gasketed joints shall conform to ASTM D 3212.

2.3.2.1 Not Used

2.3.2.2 High Density Polyethylene Pipe

Rubber gasket joints shall conform to ASTM C 443.

2.3.3 Not Used

2.3.4 Not Used

2.3.5 Ductile Iron Pipe

Push-on joints shall conform to AWWA C111. Mechanical joints shall conform to AWWA C111 as modified by AWWA C151. Flanged joints shall conform to AWWA C115.

2.3.6 Not Used

2.4 BRANCH CONNECTIONS

Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D 2680; saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

2.5 FRAMES AND COVERS

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or shall be of type as suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 181.4 kg. Reinforced concrete frames and covers shall be as indicated or shall conform to ASTM C 478 or ASTM C 478M. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.6 MANHOLE STEPS

Manhole steps shall comply with KDOH Standard Drawing RDB-430-03.

2.7 CEMENT MORTAR

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.7.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in concrete pipe, concrete pipe ittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking. Where aggregates are alkali reactive, as determined by Appendix XI of ASTM C 33, a cement containing less than 0.60 percent alkalies shall be used.

2.7.2 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94, compressive strength of 28 MPa days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 17 MPa at 28 days. Concrete in place shall be protected from freezing and moisture loss for seven (7) days.

2.8 STRUCTURES

2.8.1 Precast Reinforced Concrete Manhole Sections

Precast reinforced concrete manhole sections shall conform to ASTM C 478, except that portland cement shall be as specified herein. Joints shall be cement mortar, an approved mastic, rubber gaskets, a combination of these types; or the use of external preformed rubber joint seals and extruded rolls of rubber with mastic adhesive on one side.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Adjacent Facilities

3.1.1.1 Water Lines

Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be closer horizontally than 3 m to a water-supply main or service line, except that where the bottom of the water pipe will be at least 300 mm above the top of the sewer pipe, the horizontal spacing may be a minimum of 2 m. Where gravity-flow sewers cross above water lines, the sewer pipe for a distance of 3 m on each side of the crossing shall be fully encased in concrete or shall be acceptable pressure pipe with no joint closer horizontally than 1 m 3 feet to the crossing. The thickness of the concrete encasement including that at the pipe joints shall be not less than 100 mm.

3.1.2 Pipe Laying

a. Pipe shall be protected during handling against impact shocks and free fall and the pipe interior shall be free of extraneous material.

b. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the sewer has a uniform invert. As the work progresses, the interior of the sewer shall be cleared of all superfluous materials.

c. Before making pipe joints all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints shall then be placed, fitted, joined, and adjusted to obtain the degree of water tightness required.

d. Not Used

e. Installations of solvent weld joint pipe, using PVC pipe and fittings shall be in accordance with ASTM F 402. All required precautions shall be taken to assure adequate trench ventilation and protection for workers installing the pipe.

3.1.2.1 Caulked Joints

The packing material shall be well packed into the annular space to prevent the entrance of lead into the pipe. The remainder of the space shall be filled with molten lead that is hot enough to show a rapid change in color when stirred. Scum shall be removed before pouring. The lead shall be caulked to form a tight joint without overstraining the bell and shall have a minimum depth of 25 mm after caulking.

3.1.2.2 Trenches

Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for as long a period as required. When work is not in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.

3.1.2.3 Backfill

As soon as possible after the joint is made, sufficient backfill material shall be placed along the pipe to prevent pipe movement off line or grade. Plastic pipe shall be completely covered to prevent damage from ultraviolet light.

3.1.2.4 Width of Trench

If the maximum width of the trench at the top of the pipe, as specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, is exceeded for any reason other than by direction, the Contractor shall install at no additional cost to the Government such concrete cradling, pipe encasement, or other bedding required to support the added load of the backfill.

3.1.2.5 Joints

Joints between different pipe materials shall be made as specified, using approved jointing materials.

3.1.2.6 Handling and Storage

Pipe, fittings and joint material shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities for plastic pipe, fittings, joint materials and solvents shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325M.

3.1.3 Leakage Tests

Lines shall be tested for leakage by low pressure air testing, infiltration tests or exfiltration tests, as appropriate. Low pressure air testing for vitrified clay pipes shall be as prescribed in ASTM C 828. Low pressure air testing for concrete pipes shall be as prescribed in ASTM C 828. Low pressure air testing for PVC pipe shall be as prescribed in UBPPA UNI-B-6. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C 828 and ASTM C 924, after consultation with the pipe manufacturer. Prior to infiltration or exfiltration tests the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 600 mm or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. When the

Contracting Officer determines that infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so that a head of at least 600 mm is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re-established. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed 600 liters per 10 mm diameter per kilometer of pipeline per day or 50 mL per 5 mm diameter per 100 meters of pipeline per hour. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Government.

3.1.4 Test for Deflection

When flexible pipe is used, a deflection test shall be made on the entire length of the installed pipeline not less than 30 days after the completion of all work including the leakage test, backfill, and placement of any fill, grading, paving, concrete, or superimposed loads. Deflection shall be determined by use of a deflection device or by use of a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. The ball, cylinder, or circular sections shall have a diameter, or minor diameter as applicable, of 92.5 percent of the inside diameter of the pipe. A tolerance of plus 0.5 percent will be permitted. The ball, cylinder, or circular sections shall be of a homogeneous material throughout, shall have a density greater than 1.0 as related to water at 4.0°C, and shall have a surface brinell hardness of not less than 150. It shall be center bored and through bolted with a 6.4 mm minimum diameter steel shaft having a yield strength of 480 MPa or more, with eyes at each end for attaching pulling cables. The eye shall be suitably backed with flange or heavy washer such that a pull exerted on the opposite end of the shaft shall produce compression throughout the remote end of the ball, cylinder or circular section. Circular sections shall be so spaced that the distance from the external faces of the front and back sections shall equal or exceed the diameter of the circular section. Failure of the ball, cylinder, or circular section to pass freely through a pipe run, either by being pulled through or by being flushed through with water, shall be cause for rejection of that run. When a deflection device is used for the test in lieu of the ball, cylinder, or circular sections described, such device shall be approved prior to use. The device shall be sensitive to 1.0 percent of the diameter of the pipe being measured and shall be accurate to 1.0 percent of the indicated dimension. Installed pipe showing deflections greater than 7.5 percent of the normal diameter of the pipe, or 5 percent for RTRP and RPMP, shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced at no cost to the Government.

3.2 CONCRETE CRADLE AND ENCASEMENT

The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.3 WYE BRANCHES

Wye branches shall be installed where sewer connections are indicated or where directed. Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

3.4 MANHOLES

3.4.1 General

Manholes shall be constructed of concrete, or precast concrete manhole sections. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar, or shall be half tile laid in concrete, or shall be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. Pipe connections shall be made to manhole using water stops, standard O-ring joints, special manhole coupling, or shall be made in accordance with the manufacturer's recommendation. The Contractor's proposed method of connection, list of materials selected, and specials required, shall be approved prior to installation. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 100 mm per meter nor more than 200 mm per meter. Free drop inside the manholes shall not exceed 500 mm, 1 foot 6 inches, measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels, and drop manholes shall be constructed whenever the free drop would otherwise be greater than 500 mm.

3.4.2 Manhole Steps

Manhole steps shall comply with KDOH Standard drawing RDB-430-03.

3.4.3 Jointing, Plastering and Sealing

Mortar joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Mortar and mastic joints between precast rings shall be full-bedded in jointing compound and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Installation of rubber gasket joints between precast rings shall be in accordance with the recommendations of the manufacturer. Precast rings may also be sealed by the use of extruded rolls of rubber with mastic adhesive on one side.

3.4.4 Frames and Covers

Unless otherwise indicated, tops of frames and covers shall be set flush with finished grade in paved areas or 50 mm higher than finished grade in unpaved areas. Frame and cover assemblies shall be sealed to manhole sections using external preformed rubber joint seals that meet the requirements of ASTM D 412 and ASTM D 624, or other methods specified in paragraph Jointing, Plastering and Sealing, unless otherwise specified.

3.4.5 External Preformed Rubber Joint Seals

External preformed rubber joint seals and extruded rolls of rubber with mastic adhesive shall meet the requirements of ASTM D 412 and ASTM C 972 to ensure conformance with paragraph Leakage Tests. The seal shall be multi-section with neoprene rubber top section and all lower sections made of Ethylene Propylene Di Monomer (EPDM) rubber with a minimum thickness of 1.5 mm. Each unit shall consist of a top and a bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. One unit shall seal a casting and up to six, 50 mm adjusting rings. The bottom section will be 305 mm in height. A 152 mm high top section will cover up to two, 50 mm adjusting rings. A 305 mm high bottom section will cover up to six, 50 mm adjusting rings. Extension sections shall cover up to two more adjusting rings. Each extension shall overlap the bottom section by 50 mm and shall be overlapped by the top section by 50 mm.

3.4.6 Vacuum Testing of Manholes

State of Tennessee requirements.

The method of vacuum testing manholes REQUIRES the use of the following criteria:

1. This method is applicable to all manholes.
2. All lifting holes and exterior joints shall be filled and pointed with non-shrink grout for concrete manholes. The exterior of the manhole must be painted as the vacuum is being applied to seal the pores of the concrete.
3. Manholes are to be tested immediately after assembly or construction and before backfilling. No standing water shall be allowed in the manhole excavation which may affect the accuracy of the test.
4. All pipes and other openings into the manhole shall be suitably plugged in such a manner as to prevent displacement of the plugs while the vacuum is being pulled.
5. Installation and operation of the vacuum equipment and indicating devices shall be in accordance with equipment specifications and instructions provided by the manufacturer.
6. The test head may be placed in the cone section of the manhole. The rim cone is not usually tested.
7. A vacuum of 33.7382 kPa shall be drawn. The time for the vacuum to drop to 30.3644 kPa shall be recorded/.
8. Acceptance for 1.22 meter diameter manholes shall be defined as when the time to drop to 30.3644 kPa meets or exceeds the following:

MANHOLE DEPTH	DIAMETER	TME TO DROP 3.3738 kPa
1.22m to 3.05m	1.22m	75 seconds
3.05m to 4.57m	1.22m	90 seconds
4.57m to 7.62m	1.22m	105 seconds

9. For manholes 1.52m in diameter, add an additional 15 seconds and for manholes 1.83 m in diameter, add an additional 30 seconds to the time requirements for the 1.22m manholes.
10. If the manhole fails the test, necessary repairs shall be made and the vacuum test repeated until the manhole passes the test.
11. If the manhole joint mastic or gasket is displaced during the vacuum test, the manhole shall be disassembled and the seal replaced.

3.5 CONNECTIONS TO EXISTING MANHOLES

Pipe connections to existing manholes shall be made in such manner that the finish work will conform as nearly as practicable to the essential applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1-1/2 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.6 BUILDING CONNECTIONS

Building connections shall include the lines to and connection with the building waste drainage piping at a point approximately 1.5 m outside the building, unless otherwise indicated. Where building drain piping is not installed, the Contractor shall terminate the building connections approximately 1.5 m from the site of the building at a point and in a manner designated.

3.7 CLEANOUTS AND OTHER APPURTENANCES

Cleanouts and other appurtenances shall be installed where shown on the drawings or as directed by the Contracting Officer, and shall conform to the detail of the drawings.

SUBMITTAL REGISTER
(ER415-1-10)

CONTRACT NO.

TITLE AND LOCATION
DISCOM PROJECT – PHASE I/IIA, FORT CAMPBELL, KENTUCKY

CONTRACTOR

SPEC. SECTION
02730

ACT. NO.	TRANS-MITTAL NO.	ITEM NO.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER	REV-IEW-ER	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS
					SUBMIT	APPROV. NEEDED BY	MATER. NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	
a.	b.	c.	d. through q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-13 Certificates										
		1	Portland Cement; FIO.										

***** SAFETY PAYS *****

SECTION 02732

FORCE MAINS; SEWER

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SECTION 02732

FORCE MAINS; SEWER

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D	(1994) Specification for Pipeline Valves (Gate, Plug, Ball, and Check Valves)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM C 478	(1994) Precast Reinforced Concrete Manhole Sections
ASTM D 1785	(1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2122	(1990) Determining Dimensions of Thermoplastic Pipe and Fittings
ASTM D 2241	(1993) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1993) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(1990) Heat-Joining Polyolefin Pipe and Fittings
ASTM D 2774	(1972; R 1983) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2996	(1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3035	(1993) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter
ASTM D 3139	(1989; R 1995) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3308	(1991a) PTFE Resin Skived Tape

ASTM D 3350	(1993) Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3517	(1991) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe
ASTM D 4101	(1995a) Propylene Plastic Injection and Extrusion Materials
ASTM F 477	(1993) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1992) Malleable Iron Threaded Fittings, Classes 150 and 300

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C105	(1988) Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1988) Flanged Ductile-Iron Pipe with Threaded Flanges
AWWA C151	(1991) Ductile-Iron Pipe, Centrifugally Cast for Water or Other Liquids
AWWA C200	(1991) Steel Water Pipe 6 In. (150 mm) and Larger
AWWA C203	(1991) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C207	(1994) Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In.
AWWA C208	(1983; C208a; R 1989) Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C210	(1992) Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C500	(1993) Gate Valves for Water and Sewerage Systems
AWWA C508	(1982; C508a) Swing-Check Valves for Waterworks Service, 2 In. Through 24 In. NPS
AWWA C600	(1993) Installation of Ductile-Iron Water Mains and Their Appurtenances

AWWA C900	(1989; C900a) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA-TRD/9-92	(1992; Errata Mar 1993) Thrust Restraint Design for Ductile Iron Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-78	(1987; R 1992) Cast Iron Plug Valves, Flanged and Threaded Ends

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Hydrostatic Tests; FIO.

Copies of test results.

1.3 DELIVERY AND STORAGE

All material delivered and stored shall be handled and stored in such a manner that pipe, fittings and accessories, and pipe coatings are not damaged.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

Piping for force mains 100 mm (4 inches) in diameter and larger shall be ductile iron, steel, polyvinyl chloride (PVC) plastic, polyethylene (PE) plastic, or reinforced thermosetting resin pipe (RTRP). Piping 100 mm (4 inches) in diameter and larger inside pump stations shall be ductile iron pipe with bolted flange joints. Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Not Used

2.1.2 Plastic Pipe

2.1.2.1 Polyethylene (PE) Pipe

ASTM D 3350 and ASTM D 3035, minimum pressure rating of 689 kPa (100 psi) at 23 degrees C (73.4 degrees F).

2.1.2.2 Polypropylene Pipe

ASTM D 2122 and ASTM D 4101.

2.1.2.3 Polyvinyl Chloride (PVC) Pipe

PVC Pipe and Fittings 100 mm (4-Inch) Diameter and Larger: ASTM D 2241, SDR 26 , or AWWA C900, Class 150 , with push-on joints.

2.1.3 Not Used

2.1.4 Reinforced Thermosetting Resin Pipe (RTRP)

ASTM D 2996, 2413 kPa (350 psi) rated, cast iron pipe dimensions only, with elastomeric gasket joints. Fittings: AWWA C110, rated 1034 kPa (150 psi). When mechanical joint fittings are used, inside sleeves provided by the manufacturer shall be used.

2.1.5 Ductile Iron Pipe

a. Ductile Iron Pipe: AWWA C151, working pressure not less than 1034 kPa (150 psi), unless otherwise shown or specified.

b. River Crossing Pipe: AWWA C151, minimum thickness Class 54 with joints in compliance with applicable requirements of AWWA C110.

c. Fittings, Mechanical: AWWA C110, rated for 1034 kPa (150 psi).

d. Fittings, Push-On: AWWA C110 and AWWA C111, rated for 1034 kPa (150 psi).

2.1.6 Steel Pipe

a. Steel Pipe, 150 mm (6 Inches) Diameter and Larger: AWWA C200.

b. Steel Pipe Less Than 150 mm (6 Inches) Diameter: ASTM A 53, standard weight, threaded end, galvanized.

c. Fittings, 150 mm (6 Inches) Diameter and Larger: AWWA C200, fabricated in compliance with AWWA C208.

d. Fittings Less Than 150 mm (6 Inches) Diameter: ASME B16.3, galvanized.

2.2 JOINTS

2.2.1 PE Pipe

a. Heat Fusion Joints: ASTM D 2657.

b. Flanged Joints: ASME B16.1 or AWWA C207.

c. Mechanical Joints: ASME B16.1.

2.2.2 Not Used

2.2.3 PVC Pipe

a. Screw Joint Fittings: ASTM D 2464, Schedule 80.

b. Push-On Joint Fittings: ASTM D 3139, with ASTM F 477 gaskets.

c. Solvent Cement: ASTM D 2564.

d. Couplings for use with plain end pipe shall have centering rings or stops to ensure the coupling is centered on the joint.

2.2.4 Ductile Iron Pipe

a. Push-on Joints: AWWA C111.

b. Mechanical Joints: AWWA C111 as modified by AWWA C151.

c. Flanged Joints: AWWA C115.

2.2.5 Steel Pipe

a. Push-on Joints: AWWA C200.

b. Mechanical Joints: AWWA C200.

c. Flanged Joints: AWWA C207.

2.3 NOT USED

2.4 NOT USED

2.5 LIFT STATION

The lift station will be as specified in Section 11310 SEWAGE LIFT STATION.

2.6 MISCELLANEOUS MATERIALS

Miscellaneous materials shall comply with the following requirements:

2.6.1 Pipe Coatings and Linings

a. Steel, interior: AWWA C203 or AWWA C210.

b. Steel, exterior, buried: AWWA C203.

c. Steel, exterior, exposed: AWWA C210.

2.6.2 Joint Lubricants

Joint lubricants shall be as recommended by the pipe manufacturer.

2.6.3 Bolts, Nuts and Glands

AWWA C111.

2.6.4 Joint Compound

A stiff mixture of graphite and oil or inert filler and oil.

2.6.5 Joint Tape

ASTM D 3308.

2.6.6 Bond Wire

Bond wire type RHW or USE, Size 1/0 AWG, neoprene jacketed copper conductor shaped to stand clear of the joint.

PART 3 EXECUTION

3.1 INSTALLATION

Pipe, pipe fittings, and appurtenances shall be installed at the locations indicated. Excavation, trenching, and backfilling shall be as specified in Section 02316 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS.

3.1.1 Adjacent Facilities

Installation of force mains and inverted siphons near adjacent facilities shall be as specified in Section 02730 SANITARY SEWERS.

3.1.2 Cutting

Pipe shall be cut in a neat manner with mechanical cutters. Wheel cutters shall be used where practicable. Sharp and rough edges shall be ground smooth and loose material removed from the pipe before laying.

3.1.3 Laying

Except where otherwise authorized, pipe shall be laid with bells facing the direction of laying. Before lowering and while suspended, the pipe shall be inspected for defects. Defective material shall be rejected. Pipe shall be laid in compliance with the following:

a. Ductile Iron: AWWA C600.

b. Steel: AWWA C600.

c. Polyvinyl Chloride: Manufacturer's instructions.

d. Polyethylene: ASTM D 2774.

e. Reinforced Thermosetting Resin: Manufacturer's instructions.

3.1.4 Jointing

3.1.4.1 Not Used

3.1.4.2 Polyethylene Pipe

Heat fusion joints shall comply with the manufacturer's instructions concerning equipment, temperature, melt time, heat coat, and joining time. Flanged and mechanical joints shall be made in compliance with the manufacturer's instructions.

3.1.4.3 Not Used

3.1.4.4 Polyvinyl Chloride Pipe

a. Threaded joints shall be made by wrapping the male threads with joint tape or by applying an approved thread lubricant, then threading the joining members together. The joint shall be tightened with strap wrenches which will not damage the pipe and fittings. The joint shall be tightened no more than 2 threads past hand-tight.

b. Push-on joints: The ends of pipe for push-on joints shall be beveled to facilitate assembly. Pipe shall be marked to indicate when the pipe is fully seated. The gasket shall be lubricated to prevent displacement. Care shall be exercised to ensure that the gasket remains in proper position in the bell or coupling while making the joint.

c. Solvent-weld joints shall comply with the manufacturer's instructions.

3.1.4.5 Not Used

3.1.4.6 Reinforced Thermosetting Resin Pipe

Elastomeric gasket joints shall comply with the manufacturer's instructions.

3.1.4.7 Ductile Iron Pipe

Installation of mechanical and push-on type joints shall comply with AWWA C600 and the manufacturer's instructions. Installation of flanged joints shall comply with manufacturer's instructions.

3.1.4.8 Steel Pipe

Screw joints shall be made tight with joint tape or joint compound applied with a brush to the male threads only. Installation of mechanical joints, push-on joints, and flanged joints shall comply with the manufacturer's instructions.

3.1.5 Coating and Lining

Field coating of non-galvanized steel pipe shall comply with AWWA C203. The applied materials shall be tested by means of a spark-type electrical device in compliance with AWWA C203. Flaws and holidays in the coating or lining of the pipe and the pipe joints shall be repaired such that the repaired areas will be at least equal in thickness to the minimum required for the pipe.

3.1.6 Polyethylene Encasement

When installed underground, pipe shall be encased with 6 mm (mil) thick polyethylene in accordance with AWWA C105.

3.1.7 Not Used

3.1.8 Not Used

3.1.9 Not Used

3.1.10 Drain Lines

Drain lines shall be installed where indicated. The drain line shall consist of a tee in the main line with a 100 mm (4 inch) diameter branch, a 100 mm (4 inch) diameter elbow, and a 100 mm (4 inch) gate valve.

3.1.11 Thrust Restraint

Thrust Restraint shall be as specified in Section 02660 WATER LINES. Plugs, caps, tees and bends deflecting 11-1/4 degrees or more, either vertically or horizontally, shall be provided with thrust restraint. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron pipes, restrained joints.

3.1.11.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 14 MPa (2000 psi) after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.11.2 Restrained Joints

For ductile-iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA-TRD/9-92.

3.1.12 Grout

Grout for exterior joint protection on concrete pipes shall be a mix of 1 part portland cement, 2 parts sand, and of sufficient liquid consistency to flow into the joint recess beneath the diaper. Grout for interior joint protection shall be a mix of 1 part portland cement and 1 part sand. A polyurethane foam loop, impregnated with portland cement, may be substituted for grout for exterior joints.

3.1.13 Bonded Joints

Where indicated, a metallic bond shall be provided at each joint, including joints made with flexible couplings or rubber gaskets, of ferrous-metallic piping to effect continuous conductivity. The bond shall be of the thermal-weld type.

3.2 HYDROSTATIC TESTS

The pipeline shall be subjected to both a pressure test and a leakage test. The method proposed for disposal of waste water from hydrostatic tests shall be approved by the Contracting Officer. Testing shall be the responsibility of the Contractor. The test shall be witnessed by the Contracting Officer. The Contracting Officer shall be notified at least 7 days in advance of equipment tests. The final test report shall be delivered to the Contracting Officer within 30 days of the test.

3.2.1 Pressure Test

After the pipe has been installed, joints completed, thrust blocks have been in place for at least five days, and the trench has been partially backfilled, leaving the joints exposed for examination, the pipe shall be filled with water in a manner to expel all air. The pipeline shall be subjected to a test pressure of 700 kPa (100 psi) or 150 percent of the working pressure, whichever is greater, for a period of at least one hour. Each valve shall be opened and closed several times during the test. The exposed pipe, joints, fitting, and valves shall be examined for leaks. Visible leaks shall be stopped or the defective pipe, fitting, joints, or valve shall be replaced.

3.2.2 Leakage Test

The leakage test may be conducted subsequent to or concurrently with the pressure test. The amount of water permitted as leakage for the line shall be placed in a sealed container attached to the supply side of the test pump. No other source of supply will be permitted to be applied to the pump or line under test. The water shall be pumped into the line by the test pump as required to maintain the specified test pressure as described for pressure test for a 2-hour period. Exhaustion of the supply or the inability to maintain the required pressure will be considered test failure. Polyethylene pipe can experience diametric expansion and pressure elongation during initial testing. The manufacturer shall be consulted prior to testing for special testing considerations. Allowable leakage shall be determined by the following formula:

L = NDP/K Where:

L = Allowable leakage in gallons per hour.

N = Number of joints in length of pipeline tested.

D = Nominal diameter of the pipe in inches.

P = Square root of the test pressure in psig.

K = 7400 for pipe materials.

At the conclusion of the test, the amount of water remaining in the container shall be measured and the results recorded in the test report.

3.2.3 Retesting

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted until the results of the tests are within specified allowances without additional cost to the Government.

--End of Section--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 02732
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-09 Reports										

***** SAFETY PAYS *****

SECTION 02754

CONCRETE PAVEMENTS FOR SMALL PROJECTS
03/97

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***** SAFETY PAYS *****

SECTION 02754

CONCRETE PAVEMENTS FOR SMALL PROJECTS

03/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 301	(1996) Standard Specification for Structural Concrete
ACI 305R	(1991) Hot Weather Concreting

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 184	(1990) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 615	(1996) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 31	(1996) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1993) Concrete Aggregates
ASTM C 39	(1996) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94	(1996) Ready-Mixed Concrete
ASTM C 123	(1994) Lightweight Pieces in Aggregate
ASTM C 143	(1990a) Slump of Hydraulic Cement Concrete
ASTM C 150	(1996) Portland Cement
ASTM C 192	(1990a) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1991b) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1995) Air-Entraining Admixtures for Concrete
ASTM C 494	(1992) Chemical Admixtures for Concrete
ASTM C 595	(1995a) Blended Hydraulic Cements

ASTM C 618 (1996a) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

ASTM C 666 (1992) Resistance of Concrete to Rapid Freezing and Thawing

ASTM C 881 (1990) Epoxy-Resin-Base Bonding Systems for Concrete

ASTM C 989 (1994a) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

ASTM C 1077 (1995a) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

ASTM D 1751 (1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D 1752 (1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

ARMY CORPS OF ENGINEERS (COE)

COE CRD-C 130 (1989) Scratch Hardness of Coarse Aggregate Particles

COE CRD-C 300 (1990) Specifications for Membrane-Forming Compounds for Curing Concrete

COE CRD-C 540 (1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type

COE CRD-C 572 (1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100 (1990) Concrete Plant Standards

1.2 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of concrete (rigid) pavement. However, where the construction covered herein interfaces with other sections, the construction at each interface shall conform to the requirements of both this section and the other section, including tolerances for both.

1.3 MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for the work covered under this section of the specifications but will be considered a subsidiary obligation of the Contractor.

1.4 ACCEPTABILITY OF WORK

The pavement will be accepted on the basis of tests made by the Government and by the Contractor or its suppliers, as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing. Concrete samples shall be taken by the Contractor at the placement to determine the slump, air content, and strength of the concrete. Test cylinders shall be made for determining conformance with the

strength requirements of these specifications and, when required, for determining the time at which pavements may be placed into service. All air content measurements shall be determined in accordance with ASTM C 231. All slump tests shall be made in accordance with ASTM C 143. All test cylinders shall be 150 by 300mm cylinders and shall be fabricated in accordance with ASTM C 192, using only steel molds, cured in accordance with ASTM C 31, and tested in accordance with ASTM C 39. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory.

1.4.1 Evaluation Sampling

Sampling, testing, and mixture proportioning shall be performed by a commercial Testing Laboratory, conforming with ASTM C 1077. The individuals who sample and test concrete and concrete constituents shall be certified as American Concrete Institute (ACI) Concrete Field Testing Technicians, Grade I. The individuals who perform the inspection of concrete shall be certified as ACI Concrete Construction Inspector, Level II. All mix design, weekly quality control reports, smoothness reports, and project certification reports shall be signed by a Registered Engineer.

1.4.2 Surface Testing

Surface testing for surface smoothness, edge slump and plan grade shall be performed as indicated below by the Testing Laboratory. The measurements shall be properly referenced in accordance with paving lane identification and stationing, and a report given to the Government within 24 hours after measurement is made. A final report of surface testing, signed by a Registered Engineer, containing all surface measurements and a description of all actions taken to correct deficiencies, shall be provided to the Government upon conclusion of surface testing.

1.4.2.1 Surface Smoothness Requirements

The finished surfaces of the pavements shall have no abrupt change of 3mm or more, and all pavements shall be within the tolerances specified in Table 1 when checked with the straightedge.

TABLE 1 - STRAIGHTEDGE SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Tolerances (mm)
Roads and Streets	Longitudinal	5
	Transverse	6.5
Hardstands, Parking Areas, Open Storage Areas	Longitudinal	6.5
	Transverse	6.5

1.4.2.2 Surface Smoothness Testing Method

The surface of the pavement shall be tested with the straightedge to identify all surface irregularities exceeding the tolerances specified above. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines approximately 4.5m apart. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface, in the area between these two high points.

1.4.3 Edge Slump Testing and Conformance

When slip-form paving is used, not more than 15 percent of the total free edge of the slipformed portion of the pavement, shall have an edge slump exceeding 6mm and no slab shall have an edge slump exceeding 9mm. Edge slump shall be determined as above for surface smoothness, at each free edge of each slipformed paving lane constructed. Measurements shall be made at 1.5 to 4.5m spacings, and as directed. When edge slump exceeding the limits specified above is encountered on either side of the paving lane, additional straightedge measurements shall be made, if required, to define the linear limits of the excessive slump. The concrete for the entire width of the paving lane within these limits of excessive edge slump shall be removed and replaced. Adding concrete or paste to the edge or otherwise manipulating the plastic concrete after the sliding form has passed, or patching the hardened concrete, shall not be used as a method for correcting excessive edge slump.

1.4.4 Plan Grade Testing and Conformance

The finished surface of the pavements shall conform, within the tolerances shown in Table 1, to the lines, grades, and cross sections shown. The finished surface of new abutting pavements shall coincide at their juncture. The finished surface of airfield runway, taxiway, and apron pavements shall vary not more than 12mm above or below the plan grade line or elevation indicated. Each pavement category shall be checked by the Contractor for conformance with plan grade requirements by running lines of levels at intervals to determine the elevation at each joint intersection.

1.5 PRECONSTRUCTION TESTING OF MATERIALS

The Contractor shall not be entitled to any additional payment or extension of time because of delays caused by sampling and testing additional sources, or samples, necessitated by failure of any samples. Aggregates shall be sampled and tested by the Test Laboratory and shall be representative of the materials to be used for the project. Test results, signed by a Registered Engineer, shall be submitted 90 days before commencing paving. No aggregate shall be used unless test results show that it meets all requirements of these specifications, including compliance with ASTM C 33 and deleterious materials limitations.

1.6 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment; FIO.

Manufacturer's literature on the concrete plant; mixing equipment; hauling equipment; placing and finishing, and curing equipment; at least 7 days prior to start of paving.

SD-07 Schedules

Paving; GA.

Paving Schedules at least 7 days prior to start of paving.

SD-08 Statements

Mixture Proportions; GA.

The report of the Contractor's mixture proportioning studies showing the proportions of all ingredients and supporting information on aggregate and other materials that will be used in the manufacture of concrete, at least 14 days prior to commencing concrete placing operations.

1.7 EQUIPMENT

1.7.1 Batching and Mixing

The batching plant shall conform to NRMCA CPMB 100, the equipment requirements in ASTM C 94, and as specified. Water shall not be weighed or measured cumulatively with another ingredient. All concrete materials batching shall meet ASTM C 94 requirements. Mixers shall be stationary mixers. Truck mixers shall not be used for mixing paving concrete. Batching, mixers, mixing time, permitted reduction of mixing time, and concrete uniformity shall meet the requirements of ASTM C 94, and shall be documented in the initial weekly QC Report.

1.7.2 Transporting Equipment

Transporting equipment shall be in conformance with ASTM C 94 and as specified herein. Concrete shall be transported to the paving site in rear-dump trucks, in truck mixers designed with extra large blading and rear opening specifically for low slump concrete, or in agitators. Bottom-dump trucks shall not be used for delivery of concrete.

1.7.3 Delivery Equipment

When concrete transport equipment cannot operate on the paving lane, side-delivery transport equipment consisting of self-propelled moving conveyors shall be used to deliver concrete from the transport equipment and discharge it in front of the paver. Front-end loaders, dozers, or similar equipment shall not be used to distribute the concrete.

1.7.4 Paver-Finisher

The paver-finisher shall be a heavy-duty, self-propelled machine designed specifically for paving and finishing high quality pavement. The paver-finisher shall spread, consolidate, and shape the plastic concrete to the desired cross section in one pass. The paver-finisher shall be equipped with a full width "knock-down" auger, capable of operating in both directions, which will evenly spread the fresh concrete in front of the screed or extrusion plate. Immersion vibrators shall be gang mounted at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or completely withdrawn from the concrete. The vibrators shall be automatically controlled so that they will be immediately stopped as forward motion of the paver ceases. The spacing of the immersion vibrators across the paving lane shall be as necessary to properly consolidate the concrete, but the clear distance between vibrators shall not exceed 750mm, and the outside vibrators shall not exceed 300mm from the edge of the lane. The paver-finisher shall be equipped with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface.

1.7.4.1 Paver-Finisher with Fixed Forms

The paver-finisher shall be equipped with wheels designed to ride the forms, keep it aligned with the forms, and to spread the preventing deformation of the forms.

1.7.4.2 Slipform Paver-Finisher

The slipform paver-finisher shall be automatically controlled and crawler mounted with padded tracks. Horizontal alignment shall be electronically referenced to a taut wire guideline. Vertical alignment shall be electronically referenced on both sides of the paver to a taut wire guideline, to an approved laser control system, or to a ski operating on a completed lane. Control from a slope-adjustment control or control operating from the underlying material shall not be used.

1.7.5 Curing Equipment

Equipment for curing is specified in paragraph CURING.

1.7.6 Texturing Equipment

Texturing equipment shall be as specified below.

1.7.6.1 Fabric Drag

A fabric drag shall consist of a piece of fabric material as wide as the lane width securely attached to a separate wheel mounted frame spanning the paving lane or to one of the other similar pieces of equipment. The material shall be wide enough to provide 300 to 450mm dragging flat on the pavement surface. The fabric material shall be clean, reasonably new burlap, kept clean and saturated during use.

1.7.7 Sawing Equipment

Equipment for sawing joints and for other similar sawing of concrete shall be standard diamond-tip-bladed concrete saws mounted on a wheeled chassis.

1.7.8 Straightedge

The Contractor shall furnish and maintain at the job site one 4m straightedge for testing concrete surface smoothness. The straightedge shall be constructed of aluminum or magnesium alloy and shall have blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Straightedges shall have handles for operation on the pavement.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious materials shall be portland cement in combination with pozzolan and shall conform to appropriate specifications listed below.

2.1.1 Portland Cement

Portland cement shall conform to ASTM C 150 Type II, low-alkali.

2.1.2 Not Used

2.1.3 Not Used

2.1.4 Pozzolan (Fly Ash)

Fly ash shall conform to ASTM C 618 Class F, including all the supplementary optional physical requirements.

2.2 AGGREGATES

Aggregates shall consist of clean, hard, uncoated particles meeting the requirements of ASTM C 33, including deleterious materials, abrasion loss and soundness requirements of ASTM C 33, and other requirements specified herein. Aggregate not having a satisfactory demonstrable service record shall have a durability factor of 50 or more when subjected to freezing and thawing in concrete in accordance with ASTM C 666.

2.2.1 Coarse Aggregate

Coarse aggregate shall consist of crushed gravel, crushed stone, or a combination thereof. The nominal maximum size of the coarse aggregate shall be 19.0mm. When the nominal maximum size is greater than 25.0mm, the aggregates shall be furnished in two ASTM C 33 size groups, No. 67 and No. 4. The amount of deleterious material in each size of coarse aggregate shall not exceed the limits shown in ASTM C 33 Class 1N, 4M or 4S, depending on the weathering region, and the following limits:

a. Lightweight particles 1.0 max. percent by mass (ASTM C 123).

b. Other soft particles 2.0 max. percent by mass (COE CRD-C 130).

c. Total of all deleterious 5.0 max. percent by mass (substances listed in ASTM C 33 and above, exclusive of material finer than 0.075 mm No. 200 sieve).

d. The separation medium for lightweight particles shall have a density of 2.0 Mg/cubic meters. Sp. Gr. of 2.0.

2.2.2 Fine Aggregate

Fine aggregate shall consist of manufactured sand, and shall be composed of clean, hard, durable particles. All fine aggregate shall be composed of clean, hard, durable particles meeting the requirements of ASTM C 33 and the requirements herein. The amount of deleterious material in the fine aggregate shall not exceed the limits in ASTM C 33and shall not exceed the following limits:

a. Lightweight particles (ASTM C 123) 1.0 percent max. by mass using a medium with a density of 2.0 Mg/cubic meter. Sp. Gr. of 2.0.

b. The total of all deleterious material types, listed in ASTM C 33 and above, shall not exceed 3.0 percent of the mass of the fine aggregate.

2.3 CHEMICAL ADMIXTURES

Air-entraining admixture shall conform to ASTM C 260. An accelerator shall be used only when specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES and shall not be used to reduce the amount of cementitious material used. Accelerator shall conform to ASTM C 494 Type C. Calcium chloride and admixtures containing calcium chloride shall not be used. A water-reducing or retarding admixture shall meet the requirements of ASTM C 494. Type G or H admixtures are not allowed.

2.4 CURING MATERIALS

Membrane forming curing compound shall be a white pigmented compound conforming to COE CRD-C 300. Burlap shall be new or shall be clean material never used for anything other than curing concrete.

2.5 WATER

Water for mixing and curing shall be clean, potable, and free of injurious amounts of oil, acid, salt, or alkali.

2.6 JOINT MATERIALS

2.6.1 Expansion Joint Material

Expansion joint filler shall be a preformed material conforming to ASTM D 1751. Expansion joint filler shall be 20mm.

2.6.2 Slip Joint Material

Slip joint material shall be 6mm thick expansion joint filler conforming to ASTM D 1751 or ASTM D 1752.

2.7 REINFORCING

2.7.1 General

Reinforcing bars shall conform to ASTM A 615 Grade 60. Bar mats shall conform to ASTM A 184. Reinforcement shall be free from loose, flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete.

2.8 DOWELS AND TIE BARS

2.8.1 Dowels

Dowels shall be single piece, plain (non-deformed) steel bars conforming to ASTM A 615 Grade 60 or higher. Dowels shall be free of loose, flaky rust and loose scale and shall be clean and straight.

2.8.2 Tie Bars

Tie bars shall be deformed steel bars conforming to ASTM A 615 Grade 60. Grade 60 or higher shall not be used for bars that are bent and straightened during construction.

2.9 EPOXY RESIN

All epoxy-resin materials shall be two-component materials conforming to ASTM C 881, Class as appropriate for each application temperature to be encountered; except, that in addition, the materials shall meet the following requirements:

a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.

b. Material for use as patching for complete filling of spalls, wide cracks, and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.

c. Material for injecting cracks shall be Type IV, Grade 1.

d. Material for bonding freshly mixed portland cement concrete, mortar, or freshly mixed epoxy resin concrete to hardened concrete shall be Type V, Grade as approved.

2.10 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES

Specified flexural strength, f'c, for concrete is 4.5 MPapsi at 28 days. Maximum allowable water-cementitious material ratio is 0.45. The water-cementitious material ratio is based on absolute volume equivalency, where the ratio is determined using the weight of cement for a cement only mix, or using the total volume of cement plus pozzolan converted to an equivalent weight of cement by the absolute volume equivalency method described in ACI 211.1. The concrete shall be air-entrained with a total air content of 6 plus or minus 1 percent. The maximum allowable slump of the concrete shall be 75mm for pavement constructed with fixed forms. For slipformed pavement, the maximum allowable slump shall be 30mm. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'c and no individual test result falls below the specified strength f'c by more than 0.5 MPa. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

2.11 MIXTURE PROPORTIONS

2.11.1 Composition Concrete

Composition concrete shall be composed of cementitious material, water, fine and coarse aggregates, and admixtures. Fly ash, if used, shall be used only at a rate between 15 and 35 percent by mass of the total cementitious material. Admixtures shall consist of air entraining admixture and may also include accelerator [retarder] [water-reducing admixture]. High range water-reducing admixtures and admixtures to produce flowable concrete shall not be used. No substitutions shall be made in the materials used in the mixture proportions without additional tests to show that the quality of the concrete is satisfactory.

2.11.2 Concrete Mixture Proportioning Studies

Trial design batches, mixture proportioning studies, and testing shall be the responsibility of the Contractor, and shall be performed by the Test Laboratory and signed by a Registered Engineer. No concrete pavement shall be placed until the Contracting Officer has approved the Contractor's mixture proportions. All materials used in mixture proportioning studies shall be representative of those proposed for use on the project. If there is a change in materials, additional mixture design studies shall be made using the new materials. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in ACI 211.1. At least three different water-cementitious ratios, which will produce a range of strength encompassing that required on the project, shall be used. Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content. Maximum sand content shall be 40 percent of the total aggregate SSD weight. Aggregate quantities shall be based on the mass in a saturated surface dry condition.

2.11.3 Mixture Proportioning Procedure

The Contractor shall perform the following:

a. Fabricate, cure and test 6 test cylinders per age for each mixture at 7 and 28 days.

b. Using the average strength for each w/(c+p), plot the results from each of the three mixtures on separate graphs for w/(c+p) versus 28-day strength.

c. From the graphs select a w/(c+p) which will produce a mixture giving a 28-day strength equal to the required strength determined in accordance with the following paragraph.

2.11.4 Average Strength Required for Mixtures

In order to ensure meeting, during production, the strength requirements specified, the mixture proportions selected shall produce a required average strength, f'cr, exceeding the specified strength, f'c, in accordance with procedures in Chapter 3 of ACI 301, "Proportioning."

2.11.5 Testing

As a part of the mixture proportioning program, the proposed concrete mixture shall be subjected to testing according to ASTM 1260. The test shall be conducted as specified but for the following exceptions:

*The cement portion specified in the ASTM C 1260 procedure shall be replaced by cement and fly ash at the proportions to be used in the concrete, and the test shall be conducted once using the proposed fine aggregate and once using the proposed coarse aggregate crushed to proper gradation. The maximum allowable expansion will be 0.10% at 16 days after casting.

Test results not meeting this criteria will result in adjustment of the mixture proportions to reduce expansion or substitution of alternate aggregate(s). The contractor shall supply all materials to Waterways Experiment Station, 3909 Halls Ferry Rd., Vicksburg MS, 39180. The Government will bear the costs for this testing.

PART 3 EXECUTION

3.1 CONDITIONING OF UNDERLYING MATERIAL

Underlying material, base course, upon which concrete is to be placed shall be clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. After the underlying material has been prepared for concrete placement, no equipment shall be permitted thereon.

3.2 WEATHER LIMITATIONS

3.2.1 Hot Weather Paving

The temperature of concrete shall not exceed 32°C. Steel forms, dowels and reinforcing shall be cooled prior to concrete placement when steel temperatures are greater than 49°C.

3.2.2 Cold Weather Paving

The ambient temperature of the air at the placing site and the temperature of surfaces to receive concrete shall be not less 5°C. The temperature of the concrete when placed shall be not less than 10°C. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Calcium chloride shall not be used at any time. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 10°C for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period. Pavement damaged by freezing shall be completely removed and replaced at the Contractor's expense as specified in paragraph, REPAIR, REMOVAL, AND REPLACEMENT OF SLABS.

3.3 CONCRETE PRODUCTION

3.3.1 General Requirements

Concrete shall be deposited in front of the paver within 45 minutes from the time cement has been charged into the mixing drum, except that if the ambient temperature is above 32 °C, the time shall be reduced to 30 minutes. Every load of concrete delivered to the paving site shall be accompanied by a batch ticket from the operator of the batching plant. Tickets shall show at least the mass, or volume, of all ingredients in each batch delivered, and the time of day. Tickets shall be delivered to the placing foreman who shall keep them on file and deliver them to the Government daily.

3.3.2 Transporting and Transfer-Spreading Operations

Non-agitating equipment shall be used only on smooth roads and for haul time less than 15 minutes. No equipment shall be allowed to operate on the prepared and compacted underlying material in front of the paver-finisher.

3.4 PAVING

Pavement shall be constructed with paving and finishing equipment utilizing fixed forms or slipforms.

3.4.1 Consolidation

The paver vibrators shall be inserted into the concrete not closer to the underlying material than 50mm. The vibrators or any tamping units in front of the paver shall be automatically controlled so that they shall be stopped immediately as forward motion ceases. Excessive vibration shall not be permitted. Concrete in small, odd-shaped slabs or in locations inaccessible to the paver mounted vibration equipment shall be vibrated with a hand-operated immersion vibrator. Vibrators shall not be used to transport or spread the concrete.

3.4.2 Operation

When the paver is operated between or adjacent to previously constructed pavement (fill-in lanes), provisions shall be made to prevent damage to the previously constructed pavement, including keeping the existing pavement surface free of any debris, and placing rubber mats beneath the paver tracks. Transversely oscillating screeds and extrusion plates shall overlap the existing pavement the minimum possible, but in no case more than 200mm.

3.4.3 Required Results

The paver-finisher shall be operated to produce a thoroughly consolidated slab throughout, true to line and grade within specified tolerances. The paver-finishing operation shall produce a surface finish free of irregularities, tears, voids of any kind, and any other discontinuities. It shall produce only a very minimum of paste at the surface. Multiple passes of the paver-finisher shall not be permitted. The equipment and its operation shall produce a finished surface requiring no hand finishing, other than the use of cutting straightedges, except in very infrequent instances. No water, other than true fog sprays (mist), shall be applied to the concrete surface during paving and finishing.

3.4.4 Fixed Form Paving

Forms shall be steel, except that wood forms may be used for curves having a radius of 45m or less, and for fillets. Forms may be built up with metal or wood, added only to the base, to provide an increase in depth of not more than

25 percent. The base width of the form shall be not less than eight-tenths of the vertical height of the form, except that forms 200mm or less in vertical height shall have a base width not less than the vertical height of the form. Wood forms for curves and fillets shall be adequate in strength and rigidly braced. Forms shall be set on firm material cut true to grade so that each form section when placed will be firmly in contact with the underlying layer for its entire base. Forms shall not be set on blocks or on built-up spots of underlying material. Forms shall remain in place at least 12 hours after the concrete has been placed. Forms shall be removed without injuring the concrete.

3.4.5 Slipform Paving

The slipform paver shall shape the concrete to the specified and indicated cross section in one pass, and shall finish the surface and edges so that only a very minimum amount of hand finishing is required. Dowels shall not be installed by dowel inserters attached to the paver or by any other means of inserting the dowels into the plastic concrete. If a keyway is required, a 0.45 to 0.55mm thick metal keyway liner shall be installed as the keyway is extruded. The keyway liner shall be protected and shall remain in place and become part of the joint.

3.4.6 Placing Reinforcing Steel

Reinforcement shall be positioned on suitable chairs securely fastened to the subgrade prior to concrete placement, or may be placed on an initial layer of consolidated concrete, with the subsequent layer placed within 30 minutes of the first layer placement.

3.4.7 Placing Dowels and Tie Bars

Dowels shall be installed with alignment not greater than 1mm per 100mm. Except as otherwise specified below, location of dowels shall be within a horizontal tolerance of plus or minus 15mm and a vertical tolerance of plus or minus 5mm. The portion of each dowel intended to move within the concrete or expansion cap shall be painted with one coat of rust inhibiting primer paint, and then oiled just prior to placement. Dowels and tie bars in joints shall be omitted when the center of the dowel tie bar is located within a horizontal distance from an intersecting joint equal to or less than one-fourth of the slab thickness.

3.4.7.1 Contraction Joints

Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place by means of rigid metal basket assemblies. The dowels and tie bars shall be welded to the assembly or held irmly by mechanical locking arrangements that will prevent them from becoming distorted during paving operations. The basket assemblies shall be held securely in the proper location by means of suitable anchors.

3.4.7.2 Construction Joints-Fixed Form Paving

Installation of dowels and tie bars shall be by the bonded-in-place method, supported by means of devices fastened to the forms. Installation by removing and replacing in preformed holes will not be permitted.

3.4.7.3 Dowels Installed in Hardened Concrete

Installation shall be by bonding the dowels into holes drilled into the hardened concrete. Holes approximately 3mm greater in diameter than the dowels shall be drilled into the hardened concrete. Dowels shall be bonded in the drilled holes using epoxy resin injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel shall not be permitted. The dowels shall be held in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic collar fitted around the dowel. The vertical

alignment of the dowels shall be checked by placing the straightedge on the surface of the pavement over the top of the dowel and measuring the vertical distance between the straightedge and the beginning and ending point of the exposed part of the dowel. Where tie bars are required in longitudinal construction joints of slipform pavement, bent tie bars shall be installed at the paver, in front of the transverse screed or extrusion plate. If tie bars are required, a standard keyway shall be constructed, and the bent tie bars shall be inserted into the plastic concrete through a 0.45 to 0.55 mm thick metal keyway liner. Tie bars shall not be installed in preformed holes. The keyway liner shall be protected and shall remain in place and become part of the joint. Before placement of the adjoining paving lane, the tie bars shall be straightened, without spalling the concrete around the bar.

3.4.7.4 Expansion Joints

Dowels in expansion joints shall be installed by the bonded-in-place method or by bonding into holes drilled in hardened concrete, using procedures specified above.

3.5 FINISHING

Clary screeds, "bridge deck" finishers, or other rotating pipe or tube type equipment shall not be permitted. The sequence of machine operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Hand finishing shall be used only infrequently and only on isolated areas of odd slab shapes and in the event of a breakdown of the mechanical finishing equipment. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Equipment to be used for supplemental hand finishing shall primarily be 3 to 4m cutting straightedges; only very sparing use of bull floats shall be allowed. At no time shall water be added to the surface of the slab in any way, except for fog (mist) sprays to prevent plastic shrinkage cracking.

3.5.1 Machine Finishing With Fixed Forms

The machine shall be designed to ride the forms. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

3.5.2 Machine Finishing With Slipform Pavers

If there is sufficient concrete slurry or fluid paste on the surface that it runs over the edge of the pavement, the paving operation shall be immediately stopped and the equipment, mixture, or operation modified to prevent formation of such slurry. Any slurry which does run down the vertical edges shall be immediately removed. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens.

3.5.3 Surface Correction

While the concrete is still plastic, irregularities and marks in the pavement surface shall be eliminated by means of cutting straightedges, 3 to 4m in length. Depressions shall be filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. Long-handled, flat "bull floats" shall be used sparingly and only as necessary to correct minor, scattered surface

defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished.

3.5.4 Hand Finishing

Hand finishing operations shall be used only for those unusual slabs as specified previously. Grate tampers (jitterbugs) shall not be used. As soon as placed and vibrated, the concrete shall be struck off and screeded. The surface shall be tamped with a strike-off and tamping screed, or vibratory screed. Immediately following the final tamping of the surface, the pavement shall be floated longitudinally. Long-handled, flat bull floats shall be used sparingly and only as necessary to correct surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished. No water shall be added to the pavement during finishing operations.

3.5.5 Texturing

Before the surface sheen has disappeared and before the concrete hardens, the surface of the pavement shall be given a texture as described herein. After curing is complete, all textured surfaces shall be thoroughly power broomed to remove all debris. Any type of transverse texturing shall produce grooves in straight lines across each lane within a tolerance of plus or minus 13mm. The concrete in areas of recesses for tie-down anchors, lighting fixtures, and other outlets in the pavement shall be finished to provide a surface of the same texture as the surrounding area.

3.5.5.1 Fabric-Drag Surface Finish

Surface texture shall be applied by dragging the surface of the pavement, in the direction of the concrete placement, with a moist fabric drag. The dragging shall produce a uniform finished surface having a fine sandy texture without disfiguring marks.

3.5.6 Edging

The edges of slipformed lanes shall not be edged. After texturing has been completed, the edge of the slabs along the forms shall be carefully finished with an edging tool to form a smooth rounded surface of 3mm radius. No water shall be added to the surface during edging.

3.6 CURING

Concrete shall be continuously protected against loss of moisture and rapid temperature changes for at least 7 days from the completion of finishing operations. Unhardened concrete shall be protected from rain and flowing water. During hot weather with low humidity and/or wind, the Contractor shall institute measures to prevent plastic shrinkage cracks from developing. ACI 305R contains means of predicting plastic shrinkage cracking and preventative measures. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry. Curing shall be accomplished by one of the following methods.

3.6.1 Membrane Curing

A uniform coating of white-pigmented membrane-forming curing compound shall be applied to the entire exposed surface of the concrete including pavement edges as soon as the free water has disappeared from the surface after finishing. If evaporation is high and no moisture is present on the surface even though bleeding has not stopped, fog sprays shall be used to keep the surface moist until setting of the cement occurs. Curing compound shall then

be immediately applied. Curing compound shall be applied to the finished surfaces by means of a self-propelled automatic spraying machine, equipped with multiple spraying nozzles with wind shields, spaning the newly paved lane. The curing compound shall be applied at a maximum application rate of 5 square meters per L. The application of curing compound by hand-operated, mechanical powered pressure sprayers will be permitted only on odd widths or shapes of slabs where indicated and on concrete surfaces exposed by the removal of forms. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel and that will be free from pinholes and other discontinuities. Areas where the curing compound develops the above defects or is damaged by heavy rainfall, sawing or other construction operations within the curing period, shall be immediately resprayed.

3.6.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Impervious sheet curing shall not be used.

3.7 JOINTS

No deviation from the jointing pattern shown on the drawings shall be made without written approval of the Design District Pavement or Geotechnical Engineer. All joints shall be straight, perpendicular to the finished grade of the pavement, and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 13 mm.

3.7.1 Longitudinal Construction Joints

Dowels shall be installed in the longitudinal construction joints, or the edges shall be thickened as indicated. The dimensions of the keyway shall not vary more than plus or minus 3mm from the dimensions indicated and shall not deviate more than plus or minus 6mm from the mid-depth of the pavement. If any length of completed keyway of 1.5m or more fails to meet the above tolerances, dowels shall be installed.

3.7.2 Transverse Construction Joints

Transverse construction joints shall be installed at a planned transverse joint, at the end of each day's placing operations and when concrete placement is interrupted. Transverse construction joints shall be constructed either by utilizing headers and hand placement and finishing techniques, or by placing concrete beyond the transverse construction joint location and then saw cutting full depth and removing concrete back to the transverse construction joint location. For the latter case, dowels shall be installed using methods for dowels installed in hardened concrete described above. All transverse construction joints shall be dowelled.

3.7.3 Expansion Joints

Expansion joints shall be formed where indicated, and about any structures and features that project through or into the pavement, using preformed joint filler of the type, thickness, and width indicated, and shall extend the full slab depth. Edges of the concrete at the joint face shall be edged. The joint filler strips shall be installed to form a recess at the pavement surface to be filled with joint sealant. Expansion joints shall be constructed with dowels thickened edges for load transfer as shown.

3.7.4 Slip Joints

Slip joints shall be installed the full depth of the slab using expansion joint preformed joint filler material attached to the face of the original concrete placement. A reservoir for joint sealant shall be constructed at the top of the joint. Edges of the joint face shall be edged.

3.7.5 Contraction Joints

Transverse and longitudinal contraction joints shall be of the weakened-plane or dummy type. Longitudinal contraction joints shall be constructed by sawing a groove in the hardened concrete with a power-driven saw. Transverse contraction joints shall be constructed in conformance with requirements for sawed joints.

3.7.5.1 Sawed Joints

Sawed contraction joints shall be constructed by sawing a groove in the concrete with a 3 mm blade to the indicated depth. The time of initial sawing shall vary depending on existing and anticipated weather conditions and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. Sawing at a given joint location shall be discontinued when a crack develops ahead of the saw cut. Immediately after the joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. The surface shall be resprayed with curing compound as soon as free water disappears. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed with cord or backer rod before the concrete in the region of the joint is resprayed with curing compound.

3.7.6 Thickened Edge Joints

Underlying material in the transition area shall meet the requirements for smoothness and compaction specified for all other areas of the underlying material.

3.8 REPAIR, REMOVAL, AND REPLACEMENT OF SLABS

New pavement slabs that contain full-depth cracks shall be removed and replaced, as specified herein at no cost to the Government. Removal and replacement shall be full depth, shall be full width of the paving lane, and the limit of removal shall be from each original transverse joint . The Contracting Officer will determine whether cracks extend full depth of the pavement and may require minimum 150 mm diameter cores to be drilled on the crack to determine depth of cracking. Cores shall be drilled and the hole later filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin. Drilling of cores and refilling holes shall be at no expense to the Government. Cracks that do not extend full depth of slab shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1. The Contractor shall ensure that the crack is not widened during epoxy resin injection. Where a full depth crack intersects the original transverse joint, the slab(s) containing the crack shall be removed and replaced, with dowels installed, as required below. Spalls along joints shall be repaired as specified.

3.8.1 Removal and Replacement of Full Slabs

Unless there are keys or dowels present, all edges of the slab shall be sawcut full depth. If keys, dowels, or tie bars are present along any edges, these edges shall be sawed full depth 150mm from the edge if only keys are present, or just beyond the end of dowels or tie bars if they are present. These joints shall then be carefully sawed on the joint line to within 25mm of the depth of the dowel or key. The main slab shall be further divided by sawing full depth,

at appropriate locations, and each piece lifted out and removed. The narrow strips along keyed or doweled edges shall be carefully broken up and removed. Care shall be taken to prevent damage to the dowels, tie bars, or keys or to concrete to remain in place. Protruding portions of dowels shall be painted and lightly oiled. The joint face below keys or dowels shall be suitably trimmed so that there is no abrupt offset. If underbreak occurs at any point along any edge, the area shall be hand-filled with concrete, producing an even joint face from top to bottom, before replacing the removed slab. If underbreak over 100mm deep occurs, the entire slab containing the underbreak shall be removed and replaced. Where there are no dowels, tie bars, or keys on an edge, or where they have been damaged, dowels of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete. Original damaged dowels or tie bars shall be cut off flush with the joint face. All four edges of the new slab shall thus contain dowels or original keys or original tie bars. Prior to placement of new concrete, the underlying material shall be graded and recompacted, and the surfaces of all four joint faces shall be cleaned of all loose material and contaminants, and coated with a double application of membrane forming curing compound as bond breaker. Placement of concrete shall be as specified for original construction. The resulting joints around the new slab shall be prepared and sealed as specified.

3.8.2 Repairing Spalls Along Joints

Spalls along joints and cracks shall be repaired by first making a vertical saw cut at least 25mm outside the spalled area and to a depth of at least 50 mm. Saw cuts shall be straight lines forming rectangular areas. The concrete between the saw cut and the joint, or crack, shall be chipped out to remove all unsound concrete. The cavity shall be thoroughly cleaned with high pressure water jets supplemented with compressed air to remove all loose material. Immediately before filling the cavity, a prime coat shall be applied to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Prime coat for portland cement repairs shall be a neat cement grout and for epoxy resin repairs shall be epoxy resin, Type III, Grade 1. The cavity shall be filled with low slump portland cement concrete or mortar, or with epoxy resin concrete or mortar. Portland cement concrete shall be used for larger spalls, those more than 0.009 cubic meter in size after removal operations; portland cement mortar shall be used for spalls between 0.00085 and 0.009 cubic meter; and epoxy resin mortar or Type III, Grade 3 epoxy resin for those spalls less than 0.00085 cubic metery in size after removal operations. Portland cement concretes and mortars shall be very low slump mixtures, proportioned, mixed, placed, tamped, and cured. If the materials and procedures are approved in writing, latex modified concrete mixtures may be used for repairing spalls less than 0.009 cubic meter in size. Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, using proportions, mixing, placing, tamping and curing procedures as recommended by the manufacturer. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens. Where the spalled area abuts a joint, an insert or other bond-breaking medium shall be used to prevent bond at the joint face. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints. In lieu of sawing, spalls not adjacent to joints, and popouts, both less than 150mm in maximum dimension, may be prepared by drilling a core 50mm in diameter greater than the size of the defect, centered over the defect, and 50mm deep or 13mm into sound concrete, whichever is greater. The core hole shall be repaired as specified above for other spalls.

3.8.3 Areas Defective in Plan Grade or Smoothness

In areas not meeting the specified limits for surface smoothness and plan grade, high areas shall be reduced to attain the required smoothness and grade, except as depth is limited below. High areas shall be reduced by grinding the hardened concrete with a surface grinding machine after the concrete is 14 days or more old. The depth of grinding shall not exceed 6 mm. All pavement areas requiring plan grade or surface smoothness corrections in excess of the specified limits, shall be removed and replaced. In pavement areas given a wire comb or tined texture, areas exceeding 2 square meters that have been corrected by rubbing or grinding shall be retextured by grooving machine sawn grooves meeting the requirements for the wire comb or tined texture. All areas in which grinding has been performed will be subject to the thickness tolerances specified in paragraph

Thickness. Any grinding performed on individual slabs with excessive deficiencies shall be performed at the Contractor's own decision without entitlement to additional compensation if eventual removal of the slab is required.

3.9 NOT USED

3.10 PAVEMENT PROTECTION

The Contractor shall protect the pavement against all damage prior to final acceptance of the work. Traffic shall be excluded from the new pavement. As a construction expedient in paving intermediate lanes between newly paved pilot lanes, operation of the hauling equipment will be permitted on the new pavement after the pavement has been cured for seven (7) days and the joints have been sealed or otherwise protected. All new and existing pavement carrying construction traffic or equipment shall be continuously kept completely clean. Special cleaning and care shall be used where Contractor's traffic uses or crosses active airfield pavement.

3.11 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL (CQC)

Paragraph ACCEPTABILITY OF WORK contains additional CQC requirements. The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and submit reports as specified. When, in the opinion of the Contracting Officer, the paving operation is out of control, concrete placement shall cease.

3.11.1 Batch Plant Control

A daily report shall be prepared indicating checks made for scale accuracy with test weights, checks of batching accuracy, and corrective action taken prior to and during placement for weighing or batching, type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water masses per cubic meter, amount of water as free moisture in each size of aggregate, and the batch aggregate and water masses per cubic meter for each class of concrete batched during each day's plant operation.

3.11.2 Concrete Mixture

a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two other tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of paving. Whenever air content reaches specified limits, an immediate confirmatory test shall be made. If the second test also shows air content at or exceeding specified limits, an adjustment shall immediately be made in the amount of air-entraining admixture batched to bring air content within specified limits. If the next adjusted batch of concrete is not within specified limits, concrete placement shall be halted until concrete air content is within specified limits.

b. Slump Testing. Slump tests shall be made when test specimens are fabricated. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Whenever slump approaches the maximum limit, an adjustment shall immediately be made in the batch masses of water and fine aggregate, without exceeding the maximum w/(c+p). When a slump result exceeds the specification limit, no further concrete shall be delivered to the paving site until adjustments have been made and slump is again within the limit.

c. Temperature. The temperature of the concrete shall be measured when strength specimens are fabricated.

d. Concrete Strength Testing. Four (4) beams from the same batch shall be fabricated, cured and tested for flexural strength, testing two beams at 7-day and two beams at 28-day age. Control charts for strength, showing the 7-day and 28-day CQC flexural strengths, and the 28-day required flexural strength, shall be maintained and submitted with weekly CQC Reports.

3.11.3 Inspection Before Placing

Underlying materials, joint locations and types, construction joint faces, forms, reinforcing, dowels, and embedded items shall be inspected by a Registered Engineer in sufficient time prior to each paving operation in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing, and the certification signed by the Registered Engineer, prior to each days' paving.

3.11.4 Paving Operations

The placing foreman shall supervise all placing and paving operations, shall determine that the correct quality of concrete is placed in each location as shown, shall insure that the concrete is consolidated full depth and that finishing is performed as specified. The placing foreman shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume of concrete placed, and method of paving and any problems encountered.

3.11.5 Curing Inspection

a. Moist Curing Inspections. Each day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded. When any inspection finds an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for the area shall be extended by one (1) day.

b. Membrane Curing Inspection. At the end of each day's placement, the CQC Representative shall determine the quantity of compound used by measurement of the container; shall determine the area of concrete surface covered; shall then compute the rate of coverage in square meters per Lsquare feet per gallon and shall also note whether or not coverage is uniform. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

3.11.6 Cold-Weather Protection

At least once per day, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.11.7 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report, signed by a registered engineer, shall be prepared for the updating of control charts and test data, and all CQC inspections and actions covering the entire period from the start of the construction through the current week. Reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all CQC records. A copy of weekly reports shall be faxed to the Design District Pavement or Geotechnical Engineer. At the completion of concrete placement, a certification report shall be prepared containing mix designs, all updated control charts and concrete test data, quality control reports, smoothness reports, and other pertinent data on the concrete, with a certification by a registered engineer that the concrete placed meets all specification requirements. A copy of the certification report shall be mailed to the Design District pavement or Geotechnical Engineer.

***** SAFETY PAYS *****

--End of Section--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION DISCOM Barracks Complex Phase 1, Fort Campbell, KY				CONTRACTOR									SPEC. SECTION 02754	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.6 SUBMITTALS										
			SD-01 Data										
		1	Equipment; FIO.										
			SD-07 Schedules										
		2	Paving; GA.										
			SD-08 Statements										
		3	Mixture Proportions; GA.										

SECTION 02760

FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS
03/97

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SECTION 02760

FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS
03/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in this text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509 (1994) Elastomeric Cellular Preformed Gasket and Sealing Material

ASTM D 789 (1994) Determination of Relative Viscosity, Melting Point, and Moisture Content of Polyamide (PA)

ASTM D 3405 (1994) Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements

ASTM D 5893 (1996) Cold Applied, Single Component Chemically Curing Silicon Joint Sealant for Portland Cement Concrete Pavement

CORPS OF ENGINEERS (COE)

COE CRD-C 525 (1989) Corps of Engineers Test Method for Evaluation of Hot-Applied Joint Sealants for Bubbling Due to Heating

No separate measurement will be made for work covered under this section of the specifications but will be considered as a subsidiary obligation of the Contractor.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Manufacturer's Recommendations; GA.

Where installation procedures, or any part thereof, are required to be in accordance with the manufacturer's recommendations, printed copies of these recommendations, 30 days prior to use on the project. Installation of the material will not be allowed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

SD-07 Schedules

Construction Equipment List; FIO.

List of proposed equipment to be used in performance of construction work including descriptive data, 30 days prior to use on the project.

SD-14 Samples
Materials; GA.

Samples of the materials (sealant, primer if required, and backup material), in sufficient quantity for testing and approval 30 days prior to the beginning of work. No material will be allowed to be used until it has been approved.

1.4 NOT USED

1.5 TEST REQUIREMENTS

The joint sealant and backup or separating material shall be tested for conformance with the referenced applicable material specification. Testing of the materials shall be performed in an approved independent laboratory and certified copies of the test reports shall be submitted and approved 30 days prior to the use of the materials at the job site. Samples will be retained by the Government for possible future testing should the materials appear defective during or after application. Conformance with the requirements of the laboratory tests specified will not constitute final acceptance of the materials. Final acceptance will be based on the performance of the in-place materials.

1.6 EQUIPMENT

Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and shall be maintained in satisfactory condition at all times.

1.6.1 Joint Cleaning Equipment

1.6.1.1 Tractor-Mounted Routing Tool

The routing tool used for removing old sealant from the joints shall be of such shape and dimensions and so mounted on the tractor that it will not damage the sides of the joints. The tool shall be designed so that it can be adjusted to remove the old material to varying depths as required. The use of V-shaped tools or rotary impact routing devices will not be permitted. Hand-operated spindle routing devices may be used to clean and enlarge random cracks.

1.6.1.2 Concrete Saw

A self-propelled power saw with water-cooled diamond or abrasive saw blades will be provided for cutting joints to the depths and widths specified or for refacing joints or cleaning sawed joints where sandblasting does not provide a clean joint.

1.6.1.3 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hose, and long-wearing venturi-type nozzle of proper size, shape and opening. The maximum nozzle opening should not exceed 6.4 mm. The air compressor shall be portable and shall be capable of furnishing not less than 71 liters per second and maintaining a line pressure of not less than 621 kPa at the nozzle while in use. Compressor capability under job conditions must be demonstrated before approval. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint approximately 1 inch above the pavement surface. The height, angle of inclination and the size of the nozzle shall be adjusted as necessary to secure satisfactory results.

1.6.1.4 Waterblasting Equipment

Waterblasting equipment shall include a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water resupply equipment. The water tank and auxiliary resupply equipment shall be of sufficient capacity to permit continuous operations. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint approximately 25mm above the pavement surface. The height, angle of inclination and the size of the nozzle shall be adjustable as necessary to obtain satisfactory results. A pressure gauge mounted at the pump shall show at all times the pressure in pounds per square inch at which the equipment is operating.

1.6.1.5 Hand Tools

Hand tools may be used, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces.

1.6.2 Sealing Equipment

1.6.2.1 Hot-Poured Sealing Equipment

The unit applicators used for heating and installing ASTM D 3405 joint sealant materials shall be mobile and shall be equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the joint to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. The applicator unit shall be designed so that the sealant will circulate through the delivery hose and return to the inner kettle when not in use.

1.6.2.2 Not Used

1.6.2.3 Not Used

1.6.2.4 Cold-Applied, Single-Component Sealing Equipment

The equipment for installing ASTM D 5893 single component joint sealants shall consist of an extrusion pump, air compressor, following plate, hoses, and nozzle for transferring the sealant from the storage container into the joint opening. The dimension of the nozzle shall be such that the tip of the nozzle will extend into the joint to allow sealing from the bottom of the joint to the top. The initially approved equipment shall be maintained in good working condition, serviced in accordance with the supplier's instructions, and shall not be altered in any way without obtaining prior approval. Small hand-held air-powered equipment (i.e., caulking guns) may be used for small applications.

1.7 TRIAL JOINT SEALANT INSTALLATION

Prior to the cleaning and sealing of the joints for the entire project, a test section of at least 60 m long shall be prepared using the specified materials and approved equipment, so as to demonstrate the proposed joint preparation and sealing of all types of joints in the project. Following the completion of the test section and before any other joint is sealed, the test section shall be inspected to determine that the materials and installation meet the requirements specified. If it is determined that the materials or installation do not meet the requirements, the materials shall be removed, and the joints shall be recleaned and resealed at no cost to the Government. When the test section meets the requirements, it may be incorporated into the permanent work and paid for at the contract unit price per linear foot for sealing items scheduled. All other joints shall be prepared and sealed in the manner approved for sealing the test section.

1.8 DELIVERY AND STORAGE

Materials delivered to the job site shall be inspected for defects, unloaded, and stored with a minimum of handling to avoid damage. Storage facilities shall be provided by the Contractor at the job site for maintaining materials at the temperatures and conditions recommended by the manufacturer.

1.9 ENVIRONMENTAL CONDITIONS

The ambient air temperature and the pavement temperature within the joint wall shall be a minimum of 10°C and rising at the time of application of the materials. Sealant shall not be applied if moisture is observed in the joint.

PART 2 PRODUCTS

2.1 SEALANTS

Materials for sealing cracks in the various paved areas indicated on the drawings shall be as follows:

ASTM D 3405 and COE CRD-C 525
ASTM D 3569 and COE CRD-C 525
ASTM D 5893

2.2 PRIMERS

Primers, when their use is recommended by the manufacturer of the sealant, shall be as recommended by the manufacturer of the sealant.

2.3 BACKUP MATERIALS

The separating or backup material should be carefully selected and installed to form an effective and durable support for the sealant. Separating or blocking media should be placed to a depth below the pavement approximately equal to the width of the joint. This is to achieve a shape factor (ration of the depth of the sealant to the width of the joint) of one (1). ASTM D 5893 sealants sometimes require a shape factor of 0.5 instead of one (1). If a ASTM D 5893 sealant is to be used the placement depth of the bond breaking separating tape or backup material should be adjusted accordingly.

The backup material shall be a compressible, nonshrinking, nonstaining, nonabsorbing material and shall be nonreactive with the joint sealant. The material shall have a melting point at least 3 C greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D 789. The material shall have a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C 509. The backup material shall be 25 plus or minus 5 percent larger in diameter than the nominal width of the crack.

2.4 BOND BREAKING TAPES

The bond breaking tape or separating material shall be flexible, nonshrinkable, nonabsorbing, nonstaining, and nonreacting adhesive-backed tape. The material shall have a melting point at least 3 C greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D 789. The bond breaker tape shall be approximately 3mm wider than the nominal width of the joint and shall not bond to the joint sealant.

PART 3 EXECUTION

3.1 PREPARATION OF JOINTS

Immediately before the installation of the sealant, the joints shall be thoroughly cleaned to remove all laitance, curing compound, filler, protrusions of hardened concrete, and old sealant from the sides and upper edges of the joint space to be sealed.

3.1.1 Not Used

3.1.2 Sawing

3.1.2.1 Facing of Joints

Facing of joints shall be accomplished using a concrete saw as specified in paragraph EQUIPMENT to saw through sawed and filler-type joints to loosen and remove material until the joint is clean and open to the full specified width and depth. The blade shall be stiffened with a sufficient number of suitable dummy (used) blades or washers. Immediately following the sawing operation, the joint opening shall be thoroughly cleaned using a water jet to remove all saw cuttings and debris.

3.1.2.2 Refacing of Random Cracks

Sawing of the cracks shall be accomplished using a power-driven concrete saw as specified in paragraph EQUIPMENT. The saw blade shall be 152 mm or less in diameter to enable the saw to follow the trace of the crack. The blade shall be stiffened as necessary with suitable dummy (or used) blades or washers. Immediately following the sawing operation, the crack opening shall be thoroughly cleaned using a water jet to remove all saw cuttings and debris.

3.1.3 Waterblasting

The newly exposed concrete joint faces and the pavement surfaces extending a minimum of 13mm from the joint edges shall be waterblasted clean. A multiple-pass technique shall be used until the surfaces are free of dust, dirt, curing compound, filler, old sealant residue, or any foreign debris that might prevent the bonding of the sealant to the concrete. After final cleaning and immediately prior to sealing, the joints shall be blown out with compressed air and left completely free of debris and water.

3.1.4 Back-Up Material

When the joint opening is of a greater depth than indicated for the sealant depth, the lower portion of the joint opening shall be plugged or sealed off using a back-up material to prevent the entrance of the sealant below the specified depth. Care shall be taken to ensure that the backup material is placed at the specified depth and is not stretched or twisted during installation.

3.1.5 Bond Breaking Tape

Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, a bond breaker separating tape will be inserted to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. The tape shall be securely bonded to the bottom of the joint opening so it will not float up into the new sealant.

3.1.6 Rate of Progress of Joint Preparation

The stages of joint preparation which include sandblasting, air pressure cleaning and placing of the back-up material shall be limited to only that lineal footage that can be sealed during the same day.

3.2 PREPARATION OF SEALANT

3.2.1 Hot-Poured Sealants

Sealants conforming to ASTM D 3405 or ASTM D 3569 shall not be heated in excess of the safe heating temperature recommended by the manufacturer as shown on the sealant containers. Sealant that has been overheated or subjected to application temperatures for over 4 hours or that has remained in the applicator at the end of the day's operation shall be withdrawn and wasted.

3.2.2 Not Used

3.2.3 Not Used

3.2.4 Single-Component, Cold-Applied Sealants

The ASTM D 5893 sealant and containers shall be inspected prior to use. Any materials that contain water, hard caking of any separated constituents, nonreversible jell, or materials that are otherwise unsatisfactory shall be rejected. Settlement of constituents in a soft mass that can be readily and uniformly remixed in the field with simple tools will not be cause for rejection.

3.3 INSTALLATION OF SEALANT

3.3.1 Time of Application

Joints shall be sealed immediately following final cleaning of the joint walls and following the placement of the separating or backup material. Open joints that cannot be sealed under the conditions specified, or when rain interrupts sealing operations shall be recleaned and allowed to dry prior to installing the sealant.

3.3.2 Sealing Joints

Immediately preceding, but not more than 15 m ahead of the joint sealing operations, a final cleaning with compressed air shall be performed. The joints shall be filled from the bottom up to 6 mm plus or minus 1.5 mm below the pavement surface. Excess or spilled sealant shall be removed from the pavement by approved methods and shall be discarded. The sealant shall be installed in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the Contracting Officer. When a primer is recommended by the manufacturer, it shall be applied evenly to the joint faces in accordance with the manufacturer's instructions. Joints shall be checked frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

3.4 INSPECTION

3.4.1 Joint Cleaning

Joints shall be inspected during the cleaning process to correct improper equipment and cleaning techniques that damage the concrete pavement in any manner. Cleaned joints shall be approved prior to installation of the separating or back-up material and joint sealant.

3.4.2 Joint Sealant Application Equipment

The application equipment shall be inspected to ensure conformance to temperature requirements, proper proportioning and mixing (if two-component sealant) and proper installation. Evidences of bubbling, improper

installation, failure to cure or set shall be cause to suspend operations until causes of the deficiencies are determined and corrected.

3.4.3 Joint Sealant

The joint sealant shall be inspected for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified herein at no additional cost to the Government.

3.5 CLEAN-UP

Upon completion of the project, all unused materials shall be removed from the site and the pavement shall be left in a clean condition.

■ End of Section

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION DISCOM PROJECT – PHASE I?IIA, FORT CAMPBELL< KENTUCKY				CONTRACTOR										SPEC. SECTION 02760
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-06 Instructions										
		1	Manufacturer's Recommendations; GA.										
			SD-07 Schedules										
		2	Construction Equipment List; FIO.										
			SD-14 Samples										
		3	Materials; GA.										

SAFETY PAYS

SECTION 02831

CHAIN LINK FENCE
07/92

PART 1 GENERAL 02831-1
1.1 REFERENCES 02831-1
1.2 SUBMITTALS 02831-2

PART 2 PRODUCTS 02831-2
2.1 MATERIALS 02831-2

PART 3 EXECUTION 02831-4
3.1 GENERAL 02831-4
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3.5 BRACES AND TRUSS RODS 02831-4
3.6 TENSION WIRES 02831-5
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End of Section 02831-6

SAFETY PAYS

SECTION 02831

CHAIN LINK FENCE
07/92

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 121 (1992a) Zinc-Coated (Galvanized) Steel Barbed Wire

ASTM A 153 (1996) Zinc-Coated (Hot Dip) on Iron and Steel Hardware

ASTM A 176 (1994) Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip

ASTM A 392 (1996) Zinc-Coated SteelChain-Link Fence Fabric

ASTM A 478 (1995a) Chromium-Nickel Stainless and Heat-Resisting Steel Weaving and Knitting Wire

ASTM A 491 (1996) Aluminum-Coated Steel Chain-Link Fence Fabric

ASTM A 585 (1992) Aluminum-Coated Steel Barbed Wire

ASTM A 666 (1994) Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

ASTM A 780 (1993a) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings

ASTM A 824 (1992) Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence

ASTM C 94 (1996) Ready-Mixed Concrete

ASTM D 4541 (1995) Pull-Off Strength of Coatings Using Portable Adhesion Testers

ASTM F 626 (1996) Fence Fittings

ASTM F 668 (1996) Poly(Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric

ASTM F 883 (1990) Padlocks

ASTM F 900 (1994) Industrial and Commercial Swing Gates

ASTM F 1043 (1995) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework

ASTM F 1083 (1996) Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

ASTM F 1184 (1994) Industrial and Commercial Horizontal Slide Gates

ASTM G 23 (1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

ASTM G 26 (1995) Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

ASTM G 53 (1996) Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Chain Link Fence; FIO.

Statement signed by an official authorized to certify on behalf of the manufacturer attesting that the chain link fence and component materials meet the specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the following:

2.1.1 Chain Link Fence Fabric

ASTM A 392, Class 1, zinc-coated steel wire with minimum coating weight of 370 grams of zinc per square meter foot of coated surface, or ASTM A 491, Type I, aluminum-coated steel wire. Fabric shall be fabricated of 9 gauge wire woven in 50.8 mm. Fabric height shall be 1.83 m. Fabric shall be twisted and barbed on the top selvage and knuckled on the bottom selvage.

2.1.2 Gates

ASTM F 900 and/or ASTM F 1184. Gate shall be the type and swing shown. Gate frames shall conform to strength and coating requirements of ASTM F 1083 for Group IA, steel pipe, with external coating Type A, nominal pipe size (NPS) 1-1/2. Gate frames shall conform to strength and coating requirements of ASTM F 1043, for Group IC, steel pipe with external coating Type A or Type B, nominal pipe size (NPS) 1-1/2. Gate fabric shall be as specified for chain-link fabric. Each end member of gate frames shall be extended sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence. Gate leaves more than 2.44 m wide shall have either intermediate members and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 2.44 m 8 feet

wide shall have truss rods or intermediate braces. Intermediate braces shall be provided on all gate frames with an electro-mechanical lock. Gate fabric shall be attached to the gate frame by method standard with the manufacturer except that welding will not be permitted. Latches, hinges, stops, keepers, rollers, and other hardware items shall be furnished as required for the operation of the gate. Latches shall be arranged for padlocking so that the padlock will be accessible from both sides of the gate. Stops shall be provided for holding the gates in the open position.

2.1.3 Posts

ASTM F 1083, zinc-coated. Group IA, with external coating Type A steel pipe. Group IC steel pipe, zinc-coated with external coating Type A or Type B and Group II , formed steel sections, shall meet the strength and coating requirements of ASTM F 1043. Group III, ASTM F 1043 steel H-section may be used for line posts in lieu of line post shapes specified for the other classes. Sizes shall be as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Gate post shall be for the gate type specified subject to the limitation specified in ASTM F 900 and/or ASTM F 1184.

2.1.4 Braces and Rails

ASTM F 1083, zinc-coated, Group IA, steel pipe, size NPS 1-1/4. Group IC steel pipe, zinc-coated, shall meet the strength and coating requirements of ASTM F 1043. Group II , formed steel sections, size 42.16 mm, conforming to ASTM F 1043, may be used as braces and rails if Group II line posts are furnished.

2.1.5 Tension Wire

Tension wire shall be Type I or Type II, Class 2 coating, in accordance with ASTM A 824.

2.1.6 Accessories

ASTM F 626. Ferrous accessories shall be zinc or aluminum coated. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment. Barbed wire shall be 2 strand, 12-1/2 gauge wire, zinc-coated, Class 3 in accordance with ASTM A 121 or aluminum coated Type I in accordance with ASTM A 585. Barbed wire shall be four-point barbed type steel wire. Barbed wire support arms shall be the single arm type and of the design required for the post furnished. Tie wire for attaching fabric to rails, braces, and posts shall be 9 gauge steel wire and match the coating of the fence fabric. Miscellaneous hardware coatings shall conform to ASTM A 153 unless modified herein.

2.1.7 Not Used

2.1.8 Concrete

ASTM C 94, using 19 mm maximum size aggregate, and having minimum compressive strength of 21 Mpa at 28 days. Grout shall consist of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

2.1.9 Padlocks

ASTM F 883, Type PO1, Grade 2, Size 44.4 mm. Padlocks shall be keyed alike and each lock shall be furnished with two keys.

PART 3 EXECUTION

3.1 GENERAL

Fence shall be installed to the lines and grades indicated. The area on either side of the fence line shall be cleared to the extent indicated. Line posts shall be spaced equidistant at intervals not exceeding 3.05 m. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 152.4 m. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM A 780.

3.2 EXCAVATION

Post holes shall be cleared of loose material. Waste material shall be spread where directed. The ground surface irregularities along the fence line shall be eliminated to the extent necessary to maintain a 50.8 mm clearance between the bottom of the fabric and finish grade.

3.3 POSTS

Posts shall be set plumb and in alignment. Except where solid rock is encountered, posts shall be set in concrete to the depth indicated on the drawings. Where solid rock is encountered with no overburden, posts shall be set to a minimum depth of 457 mm in rock. Where solid rock is covered with an overburden of soil or loose rock, posts shall be set to the minimum depth indicated on the drawing unless a penetration of 457 mm in solid rock is achieved before reaching the indicated depth, in which case depth of penetration shall terminate. All portions of posts set in rock shall be grouted. Portions of posts not set in rock shall be set in concrete from the rock to ground level. Posts set in concrete shall be set in holes not less than the diameter shown on the drawings. Diameters of holes in solid rock shall be at least 25.4 mm greater than the largest cross section of the post. Concrete and grout shall be thoroughly consolidated around each post, shall be free of voids and finished to form a dome. Concrete and grout shall be allowed to cure for 72 hours prior to attachment of any item to the posts. Group II line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Driven posts shall be set to a minimum depth of 914 mm and shall be protected with drive caps when being set. Fence post rigidity shall be tested by applying a 222.4 newtons force on the post, perpendicular to the fabric, at 1.52 m above ground. Post movement measured at the point where the force is applied shall be less than or equal to 19 mm from the relaxed position. Every tenth post shall be tested for rigidity. When a post fails this test, further tests on the next four posts on either side of the failed post shall be made. All failed posts shall be removed, replaced, and retested at the Contractor's expense.

3.4 RAILS

3.4.1 Top Rail

Top rail shall be supported at each post to form a continuous brace between terminal posts. Where required, sections of top rail shall be joined using sleeves or couplings that will allow expansion or contraction of the rail. Bottom rail, if required for high security fence, shall be installed as indicated on the drawings.

3.5 BRACES AND TRUSS RODS

Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished. Horizontal (compression) braces and diagonal truss (tension) rods shall be installed on fences over 1.83 m in height. A center brace or 2 diagonal truss rods shall be installed on 3.66 m fences. Braces and truss rods

shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal. No bracing is required on fences 1.83 m high or less if a top rail is installed.

3.6 TENSION WIRES

Tension wires shall be installed along the bottom of the fence line and attached to the terminal posts of each stretch of the fence. Bottom tension wire shall be installed within the bottom 152mm of the installed fabric. Tension wire shall be pulled taut and shall be free of sag.

3.7 CHAIN LINK FABRIC

Chain link fabric shall be installed on the side of the post indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 381 mm intervals. The fabric shall be installed and pulled taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fabric shall be fastened to line posts at approximately 381 mm intervals and fastened to all rails and tension wires at approximately 610 mm intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be 50.8 mm plus or minus 12.7 mm above the ground. After the fabric installation is complete, the fabric shall be exercised by applying a 222 newtons push-pull force at the center of the fabric between posts. The use of a 133 newtons pull at the center of the panel shall cause fabric deflection of not more than 63.5 mm when pulling fabric from the post side of the fence. Every second fence panel shall meet this requirement. All failed panels shall be resecured and retested at the Contractor's expense.

3.8 BARBED WIRE SUPPORTING ARMS AND BARBED WIRE

Barbed wire supporting arms and barbed wire shall be installed as indicated and as recommended by the manufacturer. Supporting arms shall be anchored to the posts in a manner to prevent easy removal with hand tools. by an explosive-actuated tool shall not be used with gray iron or other material that can be fractured. Barbed wire shall be pulled taut and attached to the arms with clips or other means that will prevent easy removal.

3.9 GATES

Gates shall be installed at the locations shown. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Padlocks shall be attached to gates or gate posts with chains. Hinge pins, and hardware shall be welded or otherwise secured to prevent removal.

3.10 NOT USED

3.11 GROUNDING

Fences crossed by overhead powerlines in excess of 600 volts shall be grounded as specified in Section 16670 LIGHTNING PROTECTION SYSTEM. Fences shall be grounded on each side of all gates, at each corner, at the closest approach to each building located within 15m of the fence, and where the fence alignment changes more than 15 degrees. Grounding locations shall not exceed 198m. Each gate panel shall be bonded with a flexible bond strap to its gate post. Fences crossed by powerlines of 600 volts or more shall be grounded at or near the point of crossing and at distances not exceeding 45m on each side of crossing. Ground conductor shall consist of No. 8 WG solid copper wire. Grounding electrodes shall be 19 mm by 3.05 m long copper-clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode is at least 152 mm below the grade. Where driving is impracticable, electrodes shall be buried a minimum of 305 mm Deep and radially from the fence. The top of the

electrode shall be not less than 0.6 m or more than 2.4 m from the fence. Ground conductor shall be clamped to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. After installation the total resistance of fence to ground shall not be greater than 25 ohms.

-- End of Section --

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION DISCOM PROJECT - PHASE I/IIA, FORT CAMPBELL, KENTUCKY				CONTRACTOR										SPEC. SECTION 02831
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-13 Certificates										
		1	Chain Link Fence; FIO.										

SECTION 02935

TURF
06/90

PART 1 GENERAL 02935-2
1.1 REFERENCES 02935-2
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TURF
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AGRICULTURAL MARKETING SERVICE (AMS)

AMS-01	(Amended thru: Aug 1988) Federal Seed Act Regulations (Part 201-202)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 977	(1991) Emulsified Asphalt
ASTM D 2028	(1976; R 1992) Cutback Asphalt (Rapid-Curing Type)
ASTM D 2607	(1969) Peats, Mosses, Humus, and Related Products

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1909	(Basic; Notice 1) Fertilizer

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Literature; FIO.

Manufacturer's literature discussing physical characteristics, application and

installation instructions for erosion control material, and for chemical treatment material.

SD-07 Schedules

Equipment List; FIO.

A list of proposed pesticide application, seeding and mulching equipment to be used in performance of turfing operation, including descriptive data and calibration tests.

SD-08 Statements

Delivery; FIO.

Delivery schedule, at least 10 days prior to the intended date of the first delivery.

Maintenance Report; FIO.

Written record of maintenance work performed.

Turf Establishment Period; FIO.

Written calendar time period for the turf establishment period. When there is more than one turf establishment period, the boundaries of the turfed area covered for each period shall be described.

SD-13 Certificates

Certificates of compliance certifying that materials meet the requirements specified, prior to the delivery of materials. Certified copies of the reports for the following materials shall be included:

Seed; FIO.

For mixture, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, date tested and state certification.

Sod; FIO.

For species, mixture percentage, percent purity, field location.

Fertilizer; FIO.

For chemical analysis, composition percent.

Agricultural Limestone; FIO.

For calcium carbonate equivalent and sieve analysis.

Asphalt Adhesive; FIO.

For compliance with ASTM D 977 and ASTM D 2028.

Topsoil; FIO.

For pH, particle size, chemical analysis and mechanical analysis.

1.3 SOURCE INSPECTIONS

Sod material will be subject to inspection by the Contracting Officer at the growing site.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

1.4.1.1 Protection

Sod shall be protected from drying out and contamination during delivery.

1.4.1.2 Topsoil

A soil test shall be provided for topsoil delivered to the site.

1.4.1.3 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.1.4 Not Used

1.4.2 Inspection

Seed and sod shall be inspected upon arrival at the job site by the Contracting Officer for conformity to type and quality in accordance with paragraph MATERIALS. Other materials shall be inspected for meeting specified requirements and unacceptable materials shall be removed from the job site.

1.4.3 Storage

Materials shall be stored in areas designated by the Contracting Officer. Sod shall be lightly sprinkled with water, covered with moist burlap, straw, or other covering and protected from exposure to wind and direct sunlight until planted. Covering for sod shall allow air to circulate and prevent internal heat from building up. Seed, lime and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment materials shall not be stored with other landscape materials.

1.4.4 Handling

1.4.4.1 Materials

Care shall be taken to avoid injury to sod sprigs. Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.4.4.2 Time Limitation

a. Sod: Limitation of the time between harvesting and placing of sod shall be 36 hours.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Seed

2.1.1.1 Seed Classification

State-certified seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with AMS-01 and applicable state seed laws.

2.1.1.2 Seed Mixtures

Seed mixtures shall be proportioned by weight as follows:

Botanical Name	Common Name	Mixture Percent by Weight	Percent Pure Live Seed
Poa Pratensis	Kentucky Bluegrass	50	81
Festuca Ruba	Creeping Red Fescue	35	95
Agrostis Alba	Red Top	10	90
Trifolium Repens	White Butch Clover	5	97

2.1.1.3 Quality

Weed seed shall not exceed 1 percent by weight of the total mixture. Wet, moldy, or otherwise damaged seed shall be rejected.

2.1.1.4 NOT USED

2.1.1.5 Temporary Seed

The temporary seed for erosion control shall be as follows:

Botanical Name	Common Name	Percent Pure Live Seed
Lodium Perenne	Perenial Ryegrass	88

2.1.1.6 Seed Mixing

The field mixing of seed shall be performed on site in the presence of the Contracting Officer.

2.1.2 Sod

2.1.2.1 Sod Classification

Nursery-grown sod shall be provided as classified by applicable state laws. Each individual sod section shall be of a size to permit rolling and lifting without breaking.

2.1.2.2 Grass Species

Grass species shall be proportioned as follows:

Botanical Name	Common Name	Mixture Percent
Festuca Arundincea	KY 31 Fescue	70
Festuca Rubra	Creeeping Red Fescue	15
Argrostis Alba	Red Top	10
Trifolium Repens	White Dutch Clover	5

2.1.2.3 Quality

The sod shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 50 mm in any dimension, woody plant roots and other material detrimental to a healthy stand of turf. Sod that has become dry, moldy, or yellow from heating, or has irregularly shaped pieces of sod and torn or uneven ends shall be rejected.

2.1.2.4 Thickness

Sod shall be machine cut to a uniform thickness of 30 mm within a tolerance of 5 mm, excluding top growth and thatch. Measurement for thickness shall exclude top growth and thatch.

2.1.2.5 Anchors

Sod anchors shall be as recommended by the sod supplier.

2.1.3 NOT USED

2.1.4 Soil Amendments

Soil amendments shall consist of lime, fertilizer, organic soil amendments and soil conditioners meeting the following requirements.

2.1.4.1 Lime

Lime shall be agricultural limestone and shall have a minimum calcium carbonate equivalent of 90 percent and shall be ground to such a fineness that at least 90 percent will pass a 10-mesh sieve and at least 50 percent will pass a 60-mesh sieve.

2.1.4.2 Fertilizer

Fertilizer shall be commercial grade, free flowing, uniform in composition and conforming to CID A-A-1909. Granular Fertilizer: As recommended by the soil test.

2.1.4.3 Organic Soil Amendments

a. Topsoil: The existing surface soil shall be stripped and stockpiled on the site in accordance with Section 02221 EXCAVATING, FILLING and BACKFILLING. When required beyond that available from stripping, the topsoil shall be delivered. Delivered topsoil shall conform to topsoil requirements specified in Section 02221 EXCAVATING, FILLING and BACKFILLING and shall be amended as recommended by soil test.

2.1.5 Mulch

Mulch shall be free from weeds, mold, and other deleterious materials.

2.1.5.1 Straw

Straw shall be stalks from oats, wheat, rye, barley, or rice furnished
in air-dry condition and with a consistency for placing with commercial mulch-blowing equipment.

2.1.5.2 Hay

Hay shall be native hay, sudan-grass hay, broomsedge hay, or other herbaceous mowings furnished in an air-dry condition suitable for placing with commercial mulch-blowing equipment.

2.1.5.3 Wood Cellulose Fiber

Wood cellulose fiber shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate visual metering during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 4.5 to 6.0.

2.1.5.4 Wood Chips

Wood chips shall be chips or shredded bark with maximum particle size of 5 mm.

2.1.5.5 Paper Fiber Mulch

Paper fiber mulch shall be recycled news print that is shredded for the purpose of mulching seed.

2.1.6 Asphalt Adhesive

Asphalt adhesive shall conform to the following:

2.1.6.1 Emulsified Asphalt

Conforming to ASTM D 977, Grade SS-1.

2.1.6.2 Cutback Asphalt

Conforming to ASTM D 2028, designation RC-70.

2.1.7 Water

Water shall not contain elements toxic to plant life.

2.1.8 NOT USED

2.1.9 Erosion Control Material

Sol erosion control shall conform to the following:

2.1.9.1 Soil Erosion Control Blanket

Machine produced mat of wood excelsior formed from a web of interlocking wood fibers, covered on one side with either knitted straw blanket-like mat construction, covered with biodegradable plastic mesh, or interwoven biodegradable thread, plastic netting or twisted kraft paper cord netting.

2.1.9.2 Soil Erosion Control Fabric
Knitted construction of polypropylene yarn with uniform mesh openings 20 to 25 mm with strips of biodegradable paper. Filler paper strips shall last 6 to 8 months.

2.1.9.3 Soil Erosion Control Net

Heavy, twisted jute mesh weighing approximately 605 grams per meter wide with mesh openings of approximately 25 mm.

2.1.9.4 Soil Erosion Control Chemicals

High-polymer synthetic resin or cold-water emulsion of selected petroleum resins.

2.1.9.5 Hydrophilic Colloids

Hydrophilic colloids shall be physiologically harmless to plant and animal life, without phytotoxic agents. Colloids shall be naturally occurring, silicate powder based, and shall form a water insoluble membrane after curing. Colloids must resist mold growth.

2.1.9.6 Anchors

Erosion control anchor material shall be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 SEEDING AND SODDING TIMES AND CONDITIONS

3.1.1 Seeding Time

Seed shall be sown from 15 March to 15 June for spring planting and from 15 September to 15 November for fall planting.

3.1.2 Sodding Time

Sod shall be placed from 15 March to 15 June for spring planting and from 15 September to 15 November for fall planting.

3.1.3 NOT USED

3.1.4 Turfing Conditions

Turf operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the turf operations, proposed times shall be submitted to and approved by the Contracting Officer.

3.2 SITE PREPARATION

3.2.1 Grading

The Contracting Officer shall verify that finished grades are as indicated on drawings, and the placing of topsoil and the smooth grading has been completed in accordance with Section 02225 EARTHWORK FOR ROADWAYS, RAILROADS AND HARDSTANDS.

3.2.2 Application of Soil Amendments

3.2.2.1 Soil Test

A soil test shall be performed for pH, chemical analysis and mechanical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of turf specified.

3.2.2.2 Lime

Lime shall be applied at the rate recommended by the soil test. Lime shall be incorporated into the soil to a minimum depth of 100 mm or may be incorporated as part of the tillage operation.

3.2.2.3 Fertilizer

Fertilizer shall be applied at the rate recommended by the soil test. Fertilizer shall be incorporated into the soil to a minimum depth of 100 mm and may be incorporated as part of the tillage or hydroseeding operation.

3.2.2.4 NOT USED

3.2.3 Tillage

3.2.3.1 Minimum Depth

Soil on slopes gentler than 3-horizontal-to-1-vertical shall be tilled to a minimum depth of 100 mm. On slopes between 3-horizontal-to-1-vertical and 1-horizontal-to-1 vertical, the soil shall be tilled to a minimum depth of 50 mm by scarifying with heavy rakes, or other method. Rototillers shall be used where soil conditions and length of slope permit. On slopes 1-horizontal-to-1 vertical and steeper, no tillage is required.

3.2.4 Finished Grading

3.2.4.1 Preparation

Turf areas shall be filled as needed or have surplus soil removed to attain the finished grade. Drainage patterns shall be maintained as indicated on drawings. Turf areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of erosion or grade deficiencies shall conform to topsoil requirements specified in Section 02221 EXCAVATING, FILLING and

BACKFILLING. For Buildings, finished grade shall be 25 mm below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas.

3.2.4.2 Lawn Area Debris

Lawn areas shall have debris and stones larger than 25 mm in any dimension removed from the surface.

3.2.4.3 Field Area Debris

Field areas shall have debris and stones larger than 75 mm in any dimension removed from the surface.

3.2.4.4 Protection

Finished graded areas shall be protected from damage by vehicular or pedestrian traffic and erosion.

3.3 SEEDING

3.3.1 General

Prior to seeding, any previously prepared seedbed areas compacted or damaged by interim rain, traffic or other cause, shall be reworked to restore the ground condition previously specified. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

3.3.2 Equipment Calibration

The equipment to be used and the methods of turfing shall be subject to the inspection and approval of the Contracting Officer prior to commencement of turfing operations. Immediately prior to the commencement of turfing operations, the Contractor shall conduct turfing equipment calibration tests in the presence of the Contracting Officer.

3.3.3 Applying Seed

3.3.3.1 Broadcast Seeding

Seed shall be uniformly broadcast at the rate of one kilogram per hectare using broadcast seeders. Half of seed shall be broadcast in one direction, and the remainder at right angles to the first direction. Seed shall be covered to an average depth of 5 mm by disk harrow, steel mat drag, cultipacker, or other approved device.

3.3.3.2 Drill Seeding

Seed shall be uniformly drilled to an average depth of 15 mm and at the rate of one kilogram per hectare using equipment having drills not more than 160 mm apart. Row markers shall be used with the drill seeder.

3.3.3.3 Rolling

Immediately after seeding, except for slopes 3-horizontal-to-1 vertical and greater, the entire area shall be firmed with a roller not exceeding 130 kg for each meter of roller width. Areas seeded with seed drills equipped with rollers shall not be rolled.

3.3.4 Hydroseeding

Seed and fertilizer shall be added to water and thoroughly mixed at the rates specified. Wood cellulose fiber mulch shall be added at the rates recommended by the manufacturer after the seed, fertilizer and water have been thoroughly mixed, to produce a homogeneous slurry. Slurry shall be uniformly applied under pressure over the entire area. The hydroseeded area shall not be rolled.

3.3.5 Mulch

3.3.5.1 Straw or Hay Mulch

Straw or hay mulch shall be spread uniformly at the rate of 4.5 metric tons per hectare. Mulch shall be spread by hand, blower-type mulch spreader or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of a steep slope and continued uniformly until the area is covered. The mulch shall not be bunched. All seeded areas shall be mulched on the same day as the seeding.

3.3.5.2 Mechanically Anchoring

Immediately following spreading, the mulch shall be anchored to the soil by a V-type-wheel land packer, a scalloped-disk land packer designed to force mulch into the soil surface, or other suitable equipment.

3.3.5.3 Asphalt Adhesive Tackifier

When asphalt adhesive is applied to the in-place mulch, spraying shall be at the rate of between 400 to 500 liters per hectare.

3.3.5.4 Non-Asphaltic Tackifier

Hydrophilic colloid shall be applied at rate recommended by manufacturer. Apply with hydraulic equipment suitable for mixing and applying uniform mixture of tackifier.

3.3.5.5 NOT USED

3.3.5.6 Wood Cellulose Fiber
Wood cellulose fiber mulch for use with the hydraulic application of seed and fertilizer shall be applied as part of the hydroseeding operation.

3.3.6 Water

Watering shall be started within 7 days after completing the seeded area. Water shall be applied at a rate sufficient to ensure moist soil conditions to a minimum depth of 25 mm. Run-off and puddling shall be prevented.

3.4 SODDING

3.4.1 General

Areas shall be sodded as indicated. Adequate soil moisture shall be ensured prior to sodding by spraying water on the area to be sodded and wetting the soil to a minimum depth of 25 mm.

3.4.2 Placing Sod

Rows of sod shall be placed parallel to and tightly against each other. Joints shall be staggered laterally. The sod strips shall not be stretched or overlapped. All joints shall be butted tight. Voids and air drying

of roots shall be prevented. On long slopes, sod shall be laid at right angles to slopes. In ditches, sod shall be laid at right angles to the flow of water. When required, the sod shall be anchored by placing anchors a minimum distance of 600 mm on center with a minimum of 2 anchors per sod section.

3.4.3 Finishing

Air pockets shall be eliminated and a true and even surface shall be provided by tamping or rolling the sod in place. Displacement of the sod shall be assured by knitting of sod to the soil. Frayed edges shall be trimmed and holes or missing corners shall be patched in the sod.

3.4.4 Watering Sod

Watering shall be started immediately after completing each day of sodding. Water shall be applied at a rate sufficient to ensure moist soil conditions to a minimum depth of 25 mm. Run-off and puddling shall be prevented.

3.5 NOT USED

3.6 EROSION CONTROL

3.6.1 Erosion Control Material

Erosion control material, where indicated or required, shall be installed in accordance with manufacturer's instructions. Placement of the erosion control material shall be accomplished without damage to installed material or without deviation to finished grade.

3.6.2 Temporary Turf Cover

3.6.2.1 General

When there are contract delays in the turfing operation or a quick cover is required to prevent erosion, the areas designated for turf shall be seeded with a temporary seed as directed by the Contracting Officer.

3.6.2.2 Application

When no other turfing materials have been applied, the quantity of one half of the required soil amendments shall be applied and the area tilled in accordance with paragraph SITE PREPARATION. Seed shall be uniformly broadcast and applied at the rate of 1.5 kilograms per square meter. The area shall be watered as required.

3.7 NOT USED

3.8 RESTORATION AND CLEAN UP

3.8.1 Restoration

Existing turf areas, pavements and facilities that have been damaged from the turfing operation shall be restored to original condition at Contractor's expense.

3.8.2 Clean Up

Excess and waste material shall be removed from the planting operation and shall be disposed of off the site. Adjacent paved areas shall be cleaned.

3.9 PROTECTION OF TURFED AREAS

Immediately after turfing, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed by the Contracting Officer.

3.10 TURF ESTABLISHMENT PERIOD

3.10.1 Commencement

The Turf Establishment Period for establishing a healthy stand of turf shall begin on the first day of work under this contract and shall end three (3) months after the last day of turfing operations required by this contract. Written calendar time period shall be furnished to the Contracting Officer for the Turf Establishment Period. When there is more than one turf establishment period, describe the boundaries of the turfed area covered for each period.

3.10.2 Satisfactory Stand of Turf

3.10.2.1 Seeded Area

a. Lawn Area: A satisfactory stand of turf from the seeding operation for a lawn area is defined as a minimum of 400 grass plants per square meter. Bare spots shall be no larger than 150 mm square. The total bare spots shall not exceed 2 percent of the total seeded area.

b. Field Area: A satisfactory stand of turf from the seeding operation for a field area is defined as a minimum of 200 grass plants per square meter. The total bare spots shall not exceed 2 percent of the total seeded area.

3.10.2.2 Sodded Area

A satisfactory stand of turf from the sodding operation is defined as living sod uniform in color and leaf texture. Bare spots shall be no larger than 50 mm square.

3.10.2.3 NOT USED

3.10.3 Maintenance During Establishment Period

3.10.3.1 General

Maintenance of the turfed areas shall include eradicating weeds, eradicating insects and diseases, protecting embankments and ditches from erosion, maintaining erosion control materials and mulch, protecting turfed areas from traffic, mowing, watering, and post-fertilization.

3.10.3.2 Mowing

a. Lawn Areas: Lawn areas shall be mowed to a minimum height of 50 milimeters when the average height of the turf becomes 100 millimeters. Clippings shall be removed when the amount of cut turf is heavy enough to damage the turfed areas.

b. Field Areas: Field areas shall be mowed once during the season to a minimum height of 75 millimeters.

3.10.3.3 Watering

Watering shall be at intervals to obtain a moist soil condition to a minimum depth of 25 mm. Frequency of watering and quantity of water shall be adjusted in accordance with the growth of the turf. Run-off, puddling and wilting shall be prevented.

3.10.3.4 Post-Fertilization

Actual available Nitrogen carrier fertilizer shall be applied at the rate of 2.5 kilograms per hectare after the first month and again in prior to the final acceptance. The application shall be timed prior to the advent of winter dormancy and shall avoid excessively high nitrogen levels.

3.10.3.5 NOT USED

3.10.3.6 Repair

The Contractor shall re-establish as specified herein, eroded, damaged or barren areas. Mulch shall also be repaired or replaced as required.

3.10.3.7 Maintenance Report

A written record shall be furnished to the Contracting Officer of the maintenance work performed.

3.11 FINAL ACCEPTANCE

3.11.1 Preliminary Inspection

Prior to the completion of the Turf Establishment Period, a preliminary inspection shall be held by the Contracting Officer. Time for the inspection shall be established in writing. The acceptability of the turf in accordance with the Turf Establishment Period shall be determined. An unacceptable stand of turf shall be repaired as soon as turfing conditions permit.

3.11.2 Final Inspection

A final inspection shall be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Time for the inspection shall be established in writing.

SECTION 02950

TREES, SHRUBS, GROUND COVERS, AND VINES

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SECTION 02950

TREES, SHRUBS, GROUND COVERS, AND VINES

06/90

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF NURSERYMEN (AAN)

AAN-01 (1990) American Standard for Nursery Stock

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2607 (1969) Peats, Mosses, Humus, and Related Products

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1909 (Basic; Notice 1) Fertilizer

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Edging Material; FIO.

Erosion Control Material; FIO.

Manufacturer's literature discussing physical characteristics, application and installation instructions for edging material and erosion control material.

SD-07 Schedules

Application of Pesticide Material; FIO.

A list of the proposed pesticide application equipment to be used in performance of the planting work, including descriptive data and calibration tests.

SD-08 Statements

Delivery; FIO.

Application of Pesticide Material; FIO.

The following work plans, before work is started.

a. Delivery Schedule at least 10 days prior to the intended date of the first delivery.

b. Pesticide Treatment Plan, giving proposed sequence of pesticide treatment work, before work is started. The pesticide trade name, chemical composition, formulation, concentration, application rate of active ingredients and methods of application for all materials furnished, and the name and state license number of the state certified applicator shall be included.

SD-09 Reports

Soil Test; FIO.

Percolation Test; FIO.

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-13 Certificates

Topsoil; FIO.

Soil Amendments; FIO.

Plants; FIO.

Pesticide; FIO.

Certificates of compliance certifying that materials meet the requirements specified, prior to the delivery of materials. Reports for the following materials shall be included.

a. Topsoil: For pH, chemical analysis, mechanical analysis and particle size.

b. Fertilizer: For chemical analysis and composition percent.

c. Agricultural Limestone: For sieve analysis and calcium carbonate equivalent.

d. Peat: For compliance with ASTM D 2607.

e. Plant Materials: For botanical and common name, size, quantity by species, grade, nursery grown.

f. Pesticide Material: For EPA registration number and registered uses.

SD-18 Records

Plant Establishment Period; FIO.

Maintenance Report; FIO.

Maintenance Instructions; FIO.

a. Maintenance Report. Written record of maintenance work performed and quantity of plant losses and replacements.

b. Plant Establishment Period. Written calendar time period for the beginning of the plant establishment period. When there is more than one establishment period, the boundaries of the planted areas covered for each period shall be described.

c. Maintenance Instruction. Written instructions for year-round care of installed plants.

1.3 SOURCE INSPECTIONS

1.3.1 Plant Materials

Plant materials shall be subject to inspection at the growing site by the Contracting Officer.

1.3.2 Delivered Topsoil

The source of topsoil shall be subject to inspection by the Contracting Officer.

1.4 SHIPMENT, DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Shipment

1.4.1.1 Preparation

Digging and preparation for shipment shall be done in a manner that will not cause shock or damage to branches, trunk, or root systems.

a. Balled and Burlapped (BB) Plants: Ball size and ratio shall be provided as recommended by AAN-01. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be accomplished by hand digging or mechanical devices. Center the plant stem or trunk in the ball and clean cut all roots at the ball surface. No roots shall be pulled from the ground. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with twine.

b. Balled and Potted (Pot) Plants: Ball size and ratio shall be provided as recommended by AAN-01. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be accomplished by hand digging or mechanical devices. The plant stem or trunk shall be centered in the ball and all roots shall be clean cut at the ball surface. No roots shall be pulled from the ground. Containers shall be used to retain the ball unbroken. Container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

c. Balled and Platform (BP) Plants: Ball size and ratio shall be provided as recommended by AAN-01. Plants shall be prepared as BB plants and securely fastened to wood platform for shipping.

d. Bare-Root (BR) Plants: Minimum root spread shall be as recommended by AAN-01. A well branched root system characteristic of the variety specified shall be provided. No roots shall be pulled from the ground. The root system shall be protected from drying out.

e. Container-Grown (C) Plants: Container size shall be provided as recommended by AAN-01. Plants shall be grown in a container sufficiently long for new fibrous roots to have developed and for root mass to

retain its shape and hold together when removed from container. Container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

1.4.1.2 Antidesiccant Application

Plants shall be sprayed with an antidesiccant as leaf budding occurs or when plant material has soft growth.

1.4.2 Delivery

1.4.2.1 Identification

Plants shall be identified with durable waterproof labels and weather-resistant ink. Plants shall have attached labels stating the correct plant name and size.

1.4.2.2 Protection During Delivery

Plants shall be protected during delivery to prevent desiccation of the plant or damage to the roots or balls. Branches of plants shall be protected by tying-in the branches and covering all exposed branches.

1.4.2.3 Topsoil

A soil test shall be provided for topsoil delivered to the site.

1.4.2.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.2.5 Pesticide

Pesticide materials shall be delivered to the site in the original unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration numbers and the registered uses.

1.4.3 Inspection

Plant material shall be inspected upon arrival at the jobsite by the Contracting Officer for conformity to the paragraph PLANTS and paragraph Shipment, and any unacceptable plant material shall be removed from the jobsite.

1.4.4 Storage

1.4.4.1 Plant Storage

Plants not installed on the day of arrival at the site shall be stored and protected in areas designated by the Contracting Officer. Plants shall be protected from exposure to wind and shall be shaded from the sun. Covering that will allow air to circulate and prevent internal heat from building up shall be provided. Bare-root plants shall be heeled-in. All plants shall be kept in a moist condition by watering with a fine mist spray until planted.

1.4.4.2 Storage of Other Materials

Soil amendments shall be stored in dry locations away from contaminants. Pesticide materials shall not be stored with other landscape materials. Storage of materials shall be in areas designated or as approved by the Contracting Officer.

1.4.5 Handling

Care shall be taken to avoid injury to plants. Materials shall not be dropped from vehicles. Balled and burlapped plants shall be handled carefully to avoid cracking or breaking the earth ball and container-grown plants shall be handled by the container. Plants shall not be handled by the trunk or stems.

1.4.5.1 Time Limitation

a. Mulch: Limitation of time between installing plant and placing mulch is 48 hours.

b. Transplanting Existing Plants: Limitation of time between digging and replanting existing plant material is one hour.

1.5 WARRANTY

Furnished plants shall be guaranteed to be in a vigorous growing condition for a period of 12 months regardless of the contract time period. A plant shall be replaced one time under this guarantee. Transplanted existing plants require no guarantee. A written calendar time period for the guarantee of plant growth shall be furnished to the Contracting Officer.

PART 2 PRODUCTS

2.1 PLANTS

2.1.1 Varieties

Plants shall be nursery grown or plantation grown stock conforming to AAN-01 and shall be of the varieties specified in the plant list bearing botanical names listed in one or more of the publications listed under "Nomenclature" in AAN-01.

2.1.2 Substitutions

Substitutions will not be permitted without written request from the Contractor for approval by the Contracting Officer.

2.1.3 Growing Conditions

Plants shall be grown under climatic conditions similar to those in the locality of the project.

2.1.4 Quality

Well shaped, well grown, vigorous, healthy plants having healthy and well branched root systems shall be provided. Plants shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plants shall be provided that are typical of the species or variety and conforming to standards as set forth in AAN-01 and as specified herein.

2.1.4.1 Shade and Flowering Trees

A height relationship to caliper shall be provided as recommended by AAN-01. Height of branching should bear a relationship to the size and variety of tree specified and with the crown in good balance with the trunk. Trees shall not be "poled" or the leader removed.

a. Single stem: Trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there should be no division of the trunk which branches more than 150 mm from ground level.

c. Specimen: A plant shall be provided that is well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

2.1.4.2 NOT USED

2.1.4.3 NOT USED

2.1.4.4 Broadleaf Evergreen

Plants shall be provided that have ratio of height-to-spread as recommended by AAN-01. An acceptable plant shall be well shaped and recognized by the trade as typical for the variety grown in the region.

2.1.4.5 Groundcovers and Vines

Plants shall be provided with the minimum number of runners and length of runner as recommended by AAN-01. Plants shall be furnished that have heavy, well developed and balanced top with vigorous well developed root system and shall be furnished in containers.

2.1.5 Size

Plants shall be furnished in sizes indicated. Plants larger in size than specified may be provided at no additional cost to the Government.

2.1.6 Measurement

Plant measurements shall be in accordance with AAN-01.

2.2 TOPSOIL

Topsoil shall be the existing surface soil stripped to the depth indicated and stockpiled on the site in accordance with Section 02221 EXCAVATING, FILLING and BACKFILLING. Additional topsoil, if required, beyond that available from stripping operations, shall be delivered. Delivered topsoil shall conform to topsoil requirement specified in Section 02221 EXCAVATING, FILLING and BACKFILLING and shall be amended as recommended by soil tests for the plants specified.

2.2.1 Soil Test

A soil test shall be performed for pH, particle size, chemical analysis and mechanical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of plants specified.

2.3 SOIL AMENDMENTS

Soil amendments consist of lime, fertilizer, bonemeal, organic soil amendments and soil conditioner.

2.3.1 Lime

Lime shall be agricultural limestone and shall have a minimum calcium carbonate equivalent of 90 percent and shall be ground to such a fineness that at least 90 percent will pass a 10-mesh sieve and at least 50 percent will pass a 60-mesh sieve.

2.3.2 Fertilizer

Fertilizer shall be commercial grade, free flowing, uniform in composition and conforming to CID A-A-1909.

2.3.2.1 Dry Fertilizer

a. Granular fertilizer : Consists of nitrogen-phosphorous-potassium ratio: 10 percent nitrogen 10 percent phosphorous, and 10 percent potassium.

b. Controlled-Release Fertilizer: Consists of nitrogen-phosphorous-potassium ratio: 20 percent nitrogen 10 percent phosphorous, and 5 percent potassium. Controlled-release fertilizer may be in packet or tablet form.

2.3.2.2 Liquid Fertilizer

Commercially available liquid fertilizer shall consist of completely soluble plant foods suitable for application as foliage spray.

2.3.3 Bonemeal

Bonemeal shall be a finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

2.3.4 Organic Soil Amendments

2.3.4.1 Peat

Peat shall be a natural product of peat humus derived from a bog, swampland or marsh and shall conform to ASTM D 2607.

2.3.4.2 Sand

Sand shall be clean and free of toxic materials and at least 95 percent by weight shall pass a 10-mesh sieve, and 10 percent by weight shall pass a 16-mesh sieve.

2.3.4.3 Rotted Manure

Rotted manure shall be unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials and containing no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and be free of stones, sticks, and soil.

2.3.5 Soil Conditioner

For single use or in combination to meet requirements for topsoil.

2.3.5.1 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum of 95 percent calcium sulfate by volume.

2.3.5.2 Aluminum Sulfate

Aluminum sulfate shall be commercial grade.

2.4 MULCH

Mulch shall be free from weeds, mold and other deleterious materials.

2.4.1 Inert Mulch Material

Inert mulch materials shall be river gravel and shall range in size from 38 to 64 mm.

2.4.2 NOT USED

2.5 NOT USED

2.6 NOT USED

2.7 GUYING AND STAKING MATERIAL

2.7.1 Stakes

Stakes for tree support shall be rough sawn wood, free from knots, rot, cross grain, or other defects that would impair the strength. Standard stakes shall be hardwood or fir treated with pentachlorophenol.

2.7.1.1 Bracing Stakes

Bracing stakes shall be a minimum of 50 mm by 50 mm or 60 mm in diameter by 2400 mm long and pointed at one end.

2.7.1.2 Ground Stakes

Ground stakes shall be a minimum of 50 mm by 50 mm or 60 mm in diameter by 900 mm long and pointed at one end.

2.7.2 Guying Material

2.7.2.1 Guying Wire

Guying wire shall be 12-gauge annealed galvanized steel wire.

2.7.2.2 Guying Cable

Guying cable shall be a minimum of five-strand, 4.76 mm (3/16-inch) diameter cadmium plated steel cable.

2.7.3 Chafing Guard

Hose chafing guards shall be new or used 2-ply reinforced rubber or plastic hose and shall be all the same color on the project. Length shall be 1-1/2 times the circumference of the plant at its base.

2.7.4 Flags

Flags to be fastened to guys shall be white surveyor's plastic tape, 150 mm in length.

2.7.5 Turnbuckles

Turnbuckles shall be galvanized or cadmium-plated steel and have a 76.2 mm (3-inch) minimum lengthwise opening fitted with screw eyes.

2.8 EDGING MATERIAL

2.8.1 Steel

Steel edging shall be galvanized with slots provided for stakes and shall be at least 3 mm thick and 100 mm wide, and supplied in at least 4800 mm lengths.

2.8.2 NOT USED

2.8.3 NOT USED

2.8.4 Anchors

Edging material anchors shall be as recommended by the manufacturer.

2.9 WATER

Water shall not contain elements toxic to plant life.

2.10 ANTIDESICCANT

Antidesiccant shall be an emulsion that will provide a film over plant surfaces permeable enough to permit transpiration, and shall not damage the plant.

2.11 EROSION CONTROL MATERIAL

2.11.1 Soil Erosion Control Blanket

Blanket shall be machine-produced mat of wood excelsior formed from a web of interlocking wood fibers, covered on one side with either knitted straw blanket-like mat-construction, covered with biodegradable plastic mesh, or interwoven with biodegradable thread, plastic netting or twisted kraft paper cord netting.

2.11.2 Soil Erosion Control Fabric

Control fabric shall be knitted construction of polypropylene yarn with uniform mesh openings 19 to 25.4 mm (3/4 to 1 inch) square with strips of biodegradable paper. Filler paper strips shall last 6 to 8 months.

2.11.3 Soil Erosion Control Net

Control net shall be heavy, twisted jute mesh weighing approximately 300 grams per meter and 1200 mm wide with mesh openings of approximately 25 mm square.

2.11.4 Anchors

Erosion control anchors shall be as recommended by the manufacturer.

2.12 NOT USED

2.13 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide, and miticide. Pesticide material shall be labeled for use and applied only as registered by EPA and approved herbicide and insecticide.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Verify Grades

The Contracting Officer shall verify the finished grades are as indicated on drawings, and the placing of topsoil and smooth grading has been completed in accordance with Section 02210 GRADING.

3.1.2 Underground Obstructions to Planting

The location of underground utilities and facilities shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.2 SITE PREPARATION

3.2.1 Layout

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted by the Contracting Officer to meet field conditions.

3.2.2 Protection of Existing Vegetation

If lawns have been established prior to planting operations, the surrounding turf shall be covered before excavations are made in a manner that will protect turf areas. Existing trees, shrubbery, and beds that are to be preserved shall be barricaded in a manner that will effectively protect them during planting operations.

3.3 EXCAVATION

3.3.1 Obstructions Below Ground or Poor Drainage

When obstructions below ground or poor drainage affect the contract operation, proposed adjustments to plant location, type of plant and planting method or drainage correction shall be submitted to and approved by the Contracting Officer.

3.3.2 Turf Removal

Where planting beds occur in existing turf areas, the turf shall be removed to a depth that will ensure the removal of the entire root system.

3.3.3 Plant Pits

Plant pits shall be dug to produce vertical sides and flat, uncompacted bottoms. When pits are dug with an auger and the sides of the pits become glazed, the glazed surface shall be scarified. The size of plant pits shall be as shown. The 124 minimum allowable dimensions of plant pits shall be 150 mm deeper than the depth of 121 ball or the depth of base 125 roots; for ball or root spreads up to 600 mm, pit diameters shall be twice the 122 root spread; for ball or root spreads 126 from 600 to 1200 mm, pit diameters shall be 600 mm greater; for ball or root spreads over 1200 mm, pit diameters shall be 1-1/2 times the ball root spread.

3.3.4 NOT USED

3.4 PERCOLATION TEST

Test for percolation shall be done to determine positive drainage of plant pits and beds. The Contracting Officer shall be notified in writing of all soil and drainage conditions detrimental to growth of plant material and shall submit proposal for correcting the condition.

3.5 Planting Times and Conditions

3.5.1 Planting Conditions

Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted to and approved by the Contracting Officer.

3.6 INSTALLATION

3.6.1 Erosion Control

Where erosion control material is indicated or required, material shall be installed in accordance with manufacturer's instructions. Placement of the erosion control material shall be accomplished without damage to installed material or without deviation to finished grade.

3.6.2 Backfill Soil Mixture

The backfill soil mixture shall be a proportioned mixture thoroughly mixed by volume of topsoil and selected soil amendments as follows:

50 percent to mixture.

3.6.3 Setting Plants

Plants shall be set plumb and held in position until sufficient soil has been firmly placed around roots or ball. Plants shall be set in relation to surrounding grade so that they are even with the depth at which they were grown in the nursery, or container.

3.6.4 Controlled-Release Fertilizer

Controlled-release fertilizer shall be placed in packet or tablet form in the plant pit in the immediate vicinity of the feeding roots in accordance with the manufacturer's recommendations.

3.6.5 Balled and Burlapped Plants

Materials shall be removed that are metal, plastic, nylon or treated burlap, prior to backfilling. Balled and burlapped stock shall be backfilled with backfill soil mixture to approximately half the depth of the ball and then tamped and watered. Biodegradable burlap and tying material shall be carefully opened and folded back. The backfill shall be completed, tamped and watered. A 100 mm high earth saucer shall be formed around individual plants.

3.6.6 Bare-Root Plants

Bare-root plants shall be installed by arranging the roots in a natural position. Damaged roots shall be removed with a clean cut. Bare-root (BR) plants shall be backfilled with backfill soil mixture carefully worked in among the roots. The backfill and water shall be completed. A 100 mm high earth saucer shall be formed around individual plants.

3.6.7 Container-Grown, Balled and Platformed and Balled and Potted Plants

Non-biodegradable containers or platforms shall be removed without damage to the plant or root system. Biodegradable containers shall be split. The backfill shall be completed as specified for BB plants.

3.6.8 Groundcover Bed

3.6.8.1 Plant Beds in Existing Soil

Bed shall be tilled to a minimum depth of 150 mm where existing soil is to be used in-place. Selected soil amendments shall be spread uniformly over the bed. Selected soil amendments shall be a proportioned mixture as follows:

Peat; 50 percent to mixture.

The mixture shall be thoroughly incorporated into the soil to a minimum depth of 150 mm using a roto-tiller or other method to obtain a uniform and well pulverized soil mix. All sticks, stones, roots and other objectionable materials shall be removed from the surface. The bed shall be brought to a smooth and even surface blending to existing areas.

3.6.8.2 Plant Beds in Replaced Soil

When soil replacement is required, the existing soil shall be excavated and removed to a minimum depth of 150 mm and backfill soil mixture shall be placed on previously scarified subsoil to a minimum depth of 150 mm. The bed shall be brought to a smooth and even surface blending to existing areas. Settlement shall be allowed for.

3.6.8.3 Groundcover

Groundcover may be planted after the mulch is in place. Contaminating the mulch with soil shall be avoided.

3.6.9 Transplanting Existing Plants

Existing plant material to be transplanted shall be tagged on the site and/or as indicated. Existing plants shall be removed from the ground by means of mechanical devices or other method with a ball attached, meeting the requirements of paragraph SHIPMENT.

3.6.10 Staking and Guying

3.6.10.1 One Bracing Stake

Trees 1.2 to 1.8 m tall shall be held in place with one bracing stake. The tree shall be held firmly to the stake with a double strand of wire. A chafing guard shall be used where the wire contacts the tree. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or roots.

3.6.10.2 Two Bracing Stakes

Trees over 1.8 m tall shall be held in place with two bracing stakes placed on opposite sides. The tree shall be held firmly between the stakes with a double strand of wire. Chafing guards shall be used where the wire contacts the tree. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or roots.

3.6.10.3 Three Guying Wires

Trees shall be held firmly in place with three guying lines of double strand wire spaced equidistantly around the tree. The line shall be anchored with ground stakes. The line shall be anchored to the tree at a point equal to one half its height. Chafing guards shall be used where the line contacts the tree. One turnbuckle shall be centered on each line for tree straightening purposes. Ground stakes shall be driven into firm ground outside the earth saucer and plant pit with the top of the stake flush with the ground surface.

3.6.11 Flags

A flag shall be securely fastened to each guying line to be visible by pedestrians.

3.6.12 Edging Material

Edging material shall be installed in accordance with the manufacturer's recommendations and/or as indicated.

3.7 FINISHING

3.7.1 Plant Beds

Planted areas shall be uniformly edged to provide a clear-cut division line between the planted area and the adjacent turf area and to provide a shape as indicated. The entire planted area shall be raked and smoothed while maintaining the earth saucers.

3.7.2 Pruning

The total amount of foliage shall be pruned by one-fourth to one-third on installed trees and shrubs to compensate for loss of roots and transplanting shock. The typical growth habit of individual plants shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth shall not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off." Cuts or

wounds measuring a minimum 15 mm in diameter shall be painted with the specified tree wound dressing.

3.7.3 Mulch

Mulch shall be spread to a uniform thickness of 100 mm within 48 hours after planting. Mulch shall be kept out of the crowns of shrubs and off buildings, sidewalks and other facilities.

3.7.4 NOT USED

3.7.5 NOT USED

3.7.6 Water

Plants shall be watered as necessary to maintain an adequate supply of moisture within the root zone. Run-off, puddling and wilting shall be prevented.

3.7.7 Antidesiccant Application

Plants requiring further protection shall be sprayed with anti-desiccant in accordance with manufacturer's recommendations.

3.8 MAINTENANCE DURING PLANTING OPERATION

Installed plants shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed and shall continue until the plant establishment period commences. The maintenance includes watering, pruning, wound dressing, straightening and other necessary operations. Plant beds and earth saucers shall be kept free of weeds, grass and other undesired vegetation. Plants shall be checked for settlement and shall be reset proper grade as necessary. Run-off, puddling and wilting shall be prevented.

3.9 CARE OF EXISTING PLANT MATERIAL

3.9.1 Identification

Existing plant material to be treated shall be tagged on the site and/or as indicated.

3.9.2 Fertilizing Existing Trees

Holes shall be dug by hand or mechanical devices, a minimum 40 mm in diameter and 500 mm deep, distributed evenly at not more than 600 mm on center throughout the outer half of the branch spread zone of each tree.

3.9.2.1 Dry Fertilizer

Dry fertilizer shall be placed in the hole to within 100 mm of the surrounding grade.

3.9.2.2 Application

Packet, tablet or wedge-form fertilizer shall be applied in accordance with manufacturer's recommendations.

3.9.2.3 Backfill

Topsoil or sand shall be used as backfill in the hole and shall be blended to the surrounding grade.

3.9.3 NOT USED

3.9.4 NOT USED

3.10 APPLICATION OF PESTICIDE MATERIAL

When pesticide becomes necessary to remove a disease or pest, a state-certified applicator shall apply required pesticide in accordance with State EPA label restrictions and recommendations. Hydraulic equipment shall be provided for the liquid application of pesticides with a leak-proof tank, positive agitation methods, controlled application pressure and metering gauges. A pesticide treatment plan shall be provided to the Contracting Officer as specified in paragraph SUBMITTALS.

3.11 RESTORATION AND CLEAN UP

3.11.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

3.11.2 Clean Up

Excess and waste material from the planting operation shall be removed and disposed of off the site. Adjacent paved areas shall be cleared.

3.12 PLANT ESTABLISHMENT PERIOD

3.12.1 Commencement

On completion of the last day of the planting operation, the plant establishment period for maintaining installed plants in a healthy growing condition shall commence and shall be in effect for the remaining contract time period not to exceed 12 months. When the planting operation extends over more than one season or there is a variance to the planting times, plant establishment periods shall be established for the work completed, as directed. Written calendar time period shall be furnished to the Contracting Officer for the beginning of the plant establishment period. When there is more than one plant establishment period, describe the boundaries of the planted area covered for each period.

3.12.2 Maintenance During Establishment Period

3.12.2.1 General

Maintenance of plants shall include straightening plants, tightening stakes and guying material, repairing tree wrapping, protecting plant areas from erosion, maintaining erosion control material, supplementing mulch, accomplishing wound dressing, removing dead or broken tip growth by pruning, maintaining edging of beds, checking for girdling of plants and maintaining plant labels, watering, weeding, removing and replacing unhealthy plants.

3.12.2.2 Water

The plants shall be watered as necessary to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of one inch of absorbed water per week

delivered in the form of natural rain or augmented as required by periodic waterings. Run-off, puddling and wilting shall be prevented.

3.12.2.3 Weeding

Grass and weeds in earth saucers and plant beds shall not be allowed to reach a height of 80 mm before being completely removed, including the root growth.

3.12.2.4 Unhealthy Plants

A plant shall be considered unhealthy or dead when the main leader has died back, or 25 percent of the crown is dead. Determine the cause for an unhealthy plant. Unhealthy or dead plants shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

3.12.2.5 Fertilizing

The plants shall be topdressed at least once during the period of establishment with dry fertilizer at the rate of 1 kilograms per square meter of plant pit or bed area or foliar feed plants with liquid fertilizer. Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy.

3.12.2.6 Settlement

Topsoil shall be added to maintain grade and to maintain earth saucers. Serious settlement affecting the setting of the plant in relation to the depth at which it was grown requires replanting in accordance with paragraph INSTALLATION.

3.12.2.7 Pesticide Treatment

Treatment for diseases or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE MATERIAL.

3.12.2.8 Maintenance Report

A written record shall be furnished to the Contracting Officer of the maintenance work performed, the quality of plant losses, cause for plant loss and replacements made on each site visit.

3.12.2.9 Maintenance Instructions

Written instructions shall be furnished to the Contracting Officer for year-round care of installed plants.

3.12.3 Replacement Plants

Plants shall be provided for replacement in accordance with paragraph PLANTS. Replacement plants shall be installed in accordance with paragraph INSTALLATION. No extended plant establishment period Shall be required for replacement plants. A plant will be replaced in accordance with paragraph WARRANTY.

3.13 FINAL ACCEPTANCE

3.13.1 Preliminary Inspection

Prior to the plant establishment period a preliminary inspection shall be held by the Contracting Officer. Time for the inspection will be established in writing. The quantity and type of plants installed and the acceptability of the plants in accordance with the plant establishment period shall be determined.

3.13.2 Final Inspection

A final inspection shall be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Time for the inspection shall be established in writing. Acceptance of the planting operation is subject to the guarantee of plant growth.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 02950
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
			Edging Material; FIO.										
			Erosion Control Material; FIO.										
			SD-07 Schedules										
			Application of Pesticide Material; FIO.										
			SD-08 Statements										
			Delivery; FIO.										
			Application of Pesticide Material; FIO.										
			SD-09 Reports										
			Soil Test; FIO.										
			Percolation Test; FIO.										
			SD-13 Certificates										
			Topsoil; FIO.										
			Soil Amendments; FIO.										
			Plants; FIO.										
			Pesticide; FIO.										
			SD-18 Records										
			Plant Establishment Period; FIO.										
			Maintenance Report; FIO.										
			Maintenance Instructions; FIO.										

SAFETY PAYS

SECTION 03100

STRUCTURAL CONCRETE FORMWORK

11/88

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 347R (1994) Guide to Formwork for Concrete

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 578 (1995) Rigid, Cellular Polystyrene Thermal Insulation

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1983) Construction and Industrial Plywood

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section C-01300 SUBMITTAL PROCEDURES:

SD-01 Data

Design; FIO.

Design analysis and calculations for form design and methodology used in the design.

Concrete Formwork; FIO.

Manufacturer's data including literature describing form materials, accessories, and form releasing agents.

SD-04 Drawings

Concrete Formwork; FIO.

Drawings showing details of formwork including, dimensions of fiber voids, joints, supports, studding and shoring, and sequence of form and shoring removal.

SD-06 Instructions

Form Releasing Agents; FIO.

Manufacturer's recommendation on method and rate of application of form releasing agents.

1.3 DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

1.4 STORAGE AND HANDLING

Fiber voids shall be stored above ground level in a dry location. Fiber voids shall be kept dry until installed and overlaid with concrete.

PART 2 PRODUCTS

2.1 FORM MATERIALS

2.1.1 Forms For Class A and Class B Finish

Forms for Class A and Class B finished surfaces shall be plywood panels conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels. Forms for round columns shall be the prefabricated seamless type.

2.1.2 Forms For Class C Finish

Forms for Class C finished surfaces shall be shiplap lumber; plywood conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II; tempered concrete form hardboard conforming to AHA A135.4; other approved concrete form material; or steel, except that steel lining on wood sheathing shall not be used. Forms for round columns may have one vertical seam.

2.1.3 Forms For Class D Finish

Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

2.1.4 Retain-In-Place Metal Forms

Retain-in-place metal forms for concrete slabs and roofs shall be as specified in Section C-05300 STEEL DECKING.

2.1.5 NOT USED

2.1.6 Form Ties

Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal. Solid backing shall be provided for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 6 mm nor more than 25 mm deep and not more than 25 mm in diameter. Removable tie rods shall be not more than 38 mm in diameter.

2.1.7 Form Releasing Agents

Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

2.1.8 NOT USED

2.2 NOT USED

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Formwork

Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section C-03300CAST-IN-PLACE STRUCTURAL CONCRETE and conforming to construction tolerance given in TABLE 1. Where concrete surfaces are to have a Class A or Class B finish, joints in form panels shall be arranged as approved. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

3.1.2 NOT USED

3.1.3 NOT USED

3.2 CHAMFERING

Except as otherwise shown, external corners that will be exposed shall be chamfered, beveled, or rounded by moldings placed in the forms.

3.3 COATING

Forms for Class A and Class B finished surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class C and D finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.4 REMOVAL OF FORMS

Forms shall be removed in a manner that will prevent injury to the concrete and ensure the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads. In no case will supporting forms or shores be removed before the concrete strength has reached 70 percent of design strengths as determined by field cured cylinders or other approved methods. This strength shall be demonstrated by job-cured test specimens, and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

TABLE 1

TOLERANCES FOR FORMED SURFACES

1. Variations from the plumb:	In any 3 m of length ----- 6 mm
a. In the lines and surfaces of columns, piers, walls	Maximum for entire length ----- 25 mm and in arises
b. For exposed corner columns, control-joint grooves, and other conspicuous lines	In any 6 m of length ----- 6 mm Maximum for entire length ---- 13 mm
2. Variation from the level or from the grades indicated on	In any 3 m of length ----- 6 mm In any bay or in any 6 m of the drawings: length -------- 10 mm
a. In slab soffits, ceilings, beam soffits, and in arises,	Maximum for entire length ---- 20 mm measured before removal of supporting shores
b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	In any bay or in any 6 m of length ---------- 6 mm Maximum for entire length ---- 13 mm
3. Variation of the linear	In any 6 m ---------- 13 mm

building lines from established position in plan	Maximum ---------- 25 mm
4. Variation of distance between walls, columns, partitions	6 mm per 3 m of distance, but not more than 13 mm in any one bay, and not more than 25 mm total variation
5. Variation in the sizes and locations of sleeves, floor openings, and wall opening	Minus ---------- 6 mm Plus ---------- 13 mm
6. Variation in cross-sectional dimensions of columns and beams and in the thickness	Minus ---------- 6 mm Plus ---------- 13 mm of slabs and walls
7. Footings:	
a. Variation of dimensions in plan	Minus ---------- 13 mm Plus ---------- 50 mm when formed or plus 75 mm when placed against uniformed excavation
b. Misplacement of	2 percent of the footing width in the direction of misplacement but no more than ---------- 50 mm
c. Reduction in thickness	Minus ---------- 5 percent of specified thickness
8. Variation in steps:	Riser ---------- 3 mm
a. In a flight of stairs	Tread ---------- 6 mm
b. In consecutive steps	Riser ---------- 2 mm Tread ---------- 3 mm

--END OF SECTION--

SECTION 03100

STRUCTURAL CONCRETE FORMWORK

PART 1 GENERAL 03100- 1
1.1 REFERENCES 03100- 1
1.2 SUBMITTALS 03100- 1
1.3 DESIGN 03100- 2
1.4 STORAGE AND HANDLING 03100- 2

PART 2 PRODUCTS 03100- 2
2.1 FORM MATERIALS 03100- 2
2.2 NOT USED 03100- 3

PART 3 EXECUTION 03100- 3
3.1 INSTALLATION 03100- 3
3.2 CHAMFERING 03100- 3
3.3 COATING 03100- 4
3.4 REMOVAL OF FORMS 03100- 4
--END OF SECTION-- 03100- 6

SUBMITTAL REGISTER (ER415-1-10)	CONTRACT NO.
TITLE AND LOCATION: DISCOM BARRACKS COMPLEX. PH I, FT. CAMPBELL, KY	CONTRACTOR
	SPEC. SECTION: C-03100

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
			Design; FIO.										C
			Concrete Formwork; FIO.										C
			SD-04 Drawings										
			Concrete Formwork; FIO.										C
			SD-06 Instructions										
			Form Releasing Agents; FIO.										C

***** SAFETY PAYS *****

SECTION 03200

CONCRETE REINFORCEMENT
09/97

PART 1 GENERAL 03200-1
1.1 REFERENCES 03200-1
1.2 SUBMITTALS 03200-1
1.3 WELDING 03200-2
1.4 DELIVERY AND STORAGE 03200-2

PART 2 PRODUCTS 03200-2
2.1 DOWELS 03200-2
2.2 FABRICATED BAR MATS 03200-2
2.3 REINFORCING STEEL 03200-2
2.4 WELDED WIRE FABRIC 03200-2
2.5 WIRE TIES 03200-2
2.6 SUPPORTS 03200-3
2.7 SYNTHETIC FIBER REINFORCEMENT 03200-3

PART 3 EXECUTION 03200-3
3.1 REINFORCEMENT 03200-3
3.2 WELDED-WIRE FABRIC PLACEMENT 03200-3
3.3 DOWEL INSTALLATION 03200-4
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--END OF SECTION-- 03200-4

***** SAFETY PAYS *****

SECTION 03200

CONCRETE REINFORCEMENT
09/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318M	(1995) Building Code Requirements for Structural Concrete and Commentary (Metric)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 82	(1995a) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 184/A 184M	(1996) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	(1994) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 615/A 615M	(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 675/A 675M	(1990a; R 1995) Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A 706/A 706M	(1995b) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM C 1116	(1995) Fiber-Reinforced Concrete and Shotcrete

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4	(1992) Structural Welding Code - Reinforcing Steel

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI MSP-1	(1996) Manual of Standard Practice

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Concrete Reinforcement System; GA.

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

SD-08 Statements

Welding; FIO.

A list of qualified welders names.

SD-13 Certificates

Reinforcing Steel; GA.

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

1.3 WELDING

Welders shall be qualified in accordance with AWS D1.4. Qualification test shall be performed at the worksite and the Contractor shall notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4.

1.4 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 DOWELS

Dowels shall conform to ASTM A 675/A 675M, Grade 80.

2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A 184/A 184M.

2.3 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 706/A 706M, grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82. In highly corrosive environments or when directed by the Contracting Officer, reinforcing steel shall conform to ASTM A 767/A 767M or ASTM A 775/A 775M as appropriate.

2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185.

2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 100 by 100 mm when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 13 mm of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

2.7 SYNTHETIC FIBER REINFORCEMENT

Synthetic fiber shall be polypropylene with a denier less than 100 and a nominal fiber length of 50 mm.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318M. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318M at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318M. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318M and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 150 mm. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated.

Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 50 mm. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 1.2 m. Fabric shall be positioned by the use of supports.

3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

3.4 SYNTHETIC FIBER REINFORCED CONCRETE

Fiber reinforcement shall be added to the concrete mix in accordance with the applicable sections of ASTM C 1116 and the recommendations of the manufacturer, and in an amount of 0.1 percent by volume.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION CONCRETE REINFORCEMENT				CONTRACTOR										SPEC. SECTION 03200
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-04 Drawings										
		1	Concrete Reinforcement System; GA.										
			SD-08 Statements										
		2	Welding; FIO.										
			SD-13 Certificates										
		3	Reinforcing Steel; GA.										

SECTION 03250

EXPANSION JOINTS, CONTRACTION JOINTS

PART 1 GENERAL 03250-2
1.1 REFERENCES 03250-2
1.2 SUBMITTALS 03250-3
1.3 DELIVERY AND STORAGE 03250-4

PART 2 PRODUCTS 03250-4
2.2 PREFORMED EXPANSION JOINT FILLER 03250-4
2.3 SEALANT 03250-4
2.4 WATERSTOPS 03250-5

PART 3 EXECUTION 03250-5
3.1 JOINTS 03250-5
3.2 WATERSTOPS, INSTALLATION AND SPLICES 03250-6
3.3 CONSTRUCTION JOINTS 03250-7

SECTION 03250

EXPANSION JOINTS, CONTRACTION JOINTS

07/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1982; R 1988) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 109M	(1993) Steel, Strip, Carbon, Cold-Rolled
ASTM A 167	(1994; Rev. A) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 480M	(1994b) General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
ASTM A 570M	(1992; R 1993) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM B 152M	(1993a) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 370	(1992) Copper Sheet and Strip for Building Construction
ASTM C 919	(1984; R 1992) Standard Practice for Use of Sealants in Acoustical Applications
ASTM C 920	(1987) Elastomeric Joint Sealants
ASTM D 412	(1992) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 471	(1979; R 1991) Rubber Property - Effect of Liquids
ASTM D 1190	(1974; R 1980) Concrete Joint Sealer, Hot-Poured Elastic Type
ASTM D 1191	(1984) Testing Concrete Joint Sealers
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1854	(1974; R 1990) Jet-Fuel-Resistant Concrete Joint

	Sealer, Hot-Poured Elastic Type
ASTM D 1855	(1989) Test Method for Jet-Fuel Resistant Concrete Joint Sealer, Hot-Poured Elastic Type
ASTM D 2628	(1991) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D 2835	(1989; R 1993) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements
ASTM D 5249	(1992) Backer Material for Use With Cold and Hot -Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

CORPS OF ENGINEERS (COE)

COE CRD-C 513	(1974) Corps of Engineers Specifications for Rubber Waterstops
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-01 Data

Preformed Expansion Joint Filler; FIO.

Sealant; FIO.

Waterstops; FIO.

Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers (when required by sealant manufacturer); preformed compression seals; and waterstops.

SD-04 Drawings

Waterstops; FIO.

Shop drawings and fabrication drawings provided by the manufacturer or prepared by the Contractor.

SD-06 Instructions

Preformed Expansion Joint Filler; FIO.

Sealant; FIO.

Waterstops; FIO.

Manufacturer's recommended instructions for installing preformed fillers, field-molded sealants; preformed compression seals; and waterstops; and for splicing non-metallic waterstops.

SD-13 Certificates

Preformed Expansion Joint Filler; FIO.

Sealant; FIO.

Waterstops; FIO.

Certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified.

SD-14 Samples

Preformed Compression Seals and Lubricants; FIO.

Specimens identified to indicate the manufacturer, type of material, size and quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 3 m of 25 mm nominal width or wider seal or a piece not less than 4 m of compression seal less than 25 mm nominal width. One liter of lubricant shall be provided.

Field-Molded Sealant and Primer; FIO.

Four liters of field-molded sealant and one liter of primer (when primer is recommended by the sealant manufacturer) identified to indicate manufacturer, type of material, quantity, and shipment or lot represented.
Non-metallic Waterstops and Splices; FIO.

Specimens identified to indicate manufacturer, type of material, size, quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 300 mm long cut from each 61 m of finished waterstop furnished, but not less than a total of 1 m of each type, size, and lot furnished. One splice sample of each size and type for every 50 splices made in the factory and every 10 splices made at the job site. The splice samples shall be made using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop. The total length of each splice shall be not less than 300 mm long.

1.3 DELIVERY AND STORAGE

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 10 mm thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

2.3 SEALANT

Joint sealant shall conform to the following:

2.3.1 Preformed Polychloroprene Elastomeric Type

ASTM D 2628.

2.3.2 Lubricant for Preformed Compression Seals

ASTM D 2835.

2.3.3 Hot-Poured Type

ASTM D 1190 tested in accordance with ASTM D 1191.

2.3.4 Field Molded Type

ASTM C 920, Type M for horizontal joints or Type NS for vertical joints, Class 25, and Use NT. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

2.3.5 Hot-Applied Jet-Fuel Resistant Type

ASTM D 1854 tested in accordance with ASTM D 1855.

2.4 WATERSTOPS

Intersection and change of direction waterstops shall be shop fabricated.

2.4.1 Flexible Metal

Copper waterstops shall conform to ASTM B 152 and ASTM B 370, or 060 soft anneal temper and 0.686 mm sheet thickness. Stainless steel waterstops shall conform to ASTM A 167 and ASTM A 480, UNS S30453 (Type 304L), and 0.9525 mm thick strip.

2.4.2 Rigid Metal

Flat steel waterstops shall conform to ASTM A 109, No. 2 (half hard) temper, No. 2 edge, No. 1 (matte or dull) finish or ASTM A 570, Grade 40.

2.4.3 Non-Metallic

Non-metallic waterstops shall be manufactured from a prime virgin resin; the compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

2.4.4 Non-Metallic Hydrophilic

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D 412 as follows: Tensile strength 2.9 MPa minimum; ultimate elongation 600 percent minimum. Hardness shall be 50 minimum on the type A durometer and the volumetric expansion ratio in distilled water at 20 degrees C shall be 3 to 1 minimum.

PART 3 EXECUTION

3.1 JOINTS

Joints shall be installed at locations indicated and as authorized.

3.1.1 Contraction Joints

Contraction joints shall be constructed by cutting the concrete with a saw after concrete has set. Joints shall be approximately 4 mm wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 25 mm.

3.1.1.2 Sawed Joints

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

3.1.2 Expansion Joints (Isolation) and Slab Control Joints

Preformed expansion joint filler shall be used in expansion, isolation, and control joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 3 mm radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top thereof to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust which shall be blown out of the groove with oil-free compressed air.

3.1.3 Joint Sealant

Sawed contraction joints, expansion joints, isolation joints, and control joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

3.1.3.1 Joints With Preformed Compression Seals

Compression seals shall be installed with equipment capable of installing joint seals to the prescribed depth without cutting, nicking, twisting, or otherwise distorting or damaging the seal or concrete and with no more than 5 percent stretching of the seal. The side of the joint and, if necessary, the sides of the compression seal shall be covered with a coating of lubricant. Butt joints shall be coated with liberal applications of lubricant.

3.1.3.2 Joints With Field-Molded Sealant

Joints shall not be sealed when the sealant material, ambient air, or concrete temperature is less than 4 degrees C. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C 919 shall be followed. Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

3.2 WATERSTOPS, INSTALLATION AND SPLICES

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting adges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures.

3.2.1 Copper and Stainless Steel

Splices in copper waterstops shall be lap joints made by brazing. Splices in stainless steel waterstops shall be welded using a TIG or MIG process utilizing a weld rod to match the stainless. All welds shall be annealed to maintain physical properties. No carbon flame shall be used in the annealing process. Damaged waterstops shall

be repaired by removing damaged portions and patching. Patches shall overlap a minimum of 25 mm onto undamaged portion of the waterstop.

3.2.2 Flat Steel

Splices in flat steel waterstops shall be properly aligned, but welded, and cleaned of excessive material.

3.2.3 Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependent), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.

3.2.3.1 Rubber Waterstop

Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified for PVC.

3.2.3.2 Polyvinyl Chloride Waterstop

Splices shall be made by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. The correct temperature shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

3.2.3.3 Quality Assurance

Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 2 mm. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 2 mm or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 13 mm in 3 m. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

3.2.4 Non-Metallic Hydrophilic Waterstop Installation

Ends to be joined shall be miter cut with sharp knife or shears. The ends shall be adhered with cyanacryiate (super glue) adhesive. When joining hydrophilic type waterstop to PVC waterstop, the hydrophilic waterstop shall be positioned as shown on the drawings. A liberal amount of a single component hydrophilic sealant shall be applied to the junction to complete the transition.

3.3 CONSTRUCTION JOINTS

Construction joints are specified in Section 03300 CONCRETE FOR BUILDING CONSTRUCTION except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION				CONTRACTOR									SPEC. SECTION 03250	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Preformed Expansion Joint Filler; FIO.										
		2	Sealant; FIO.										
		3	Waterstops; FIO.										
			SD-04 Drawings										
		4	Waterstops; FIO.										
			SD-06 Instructions										
		5	Preformed Expansion Joint Filler; FIO.										
		6	Sealant; FIO.										
		7	Waterstops; FIO.										
			SD-13 Certificates										
		8	Preformed Expansion Joint Filler; FIO.										
		9	Sealant; FIO.										
		10	Waterstops; FIO.										
			SD-14 Samples										
		11	Preformed Compression Seals and Lubricants; FIO.										
		12	Field-Molded Sealant and Primer; FIO.										
		13	Non-metallic Waterstops and Splices; FIO.										

***** SAFETY PAYS *****

*****SAFETY PAYS *****

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*****SAFETY PAYS *****

SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

09/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS(AASHTO)

AASHTO M 182	(1991I) Burlap Cloth Made From Jute or Kenaf

ACI INTERNATIONAL (ACI)

ACI 117/A117R	(1990; Errata) Standard Tolerances for Concrete Construction and Materials
ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 211.2	(1991) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 213R	(1987) Guide for Structural Lightweight Aggregate Concrete
ACI 214.3R	(1988) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	(1996) Specifications for Structural Concrete for Buildings
ACI 303R	(1991) Guide to Cast-In-Place Architectural Concrete Practice
ACI 305R	(1991) Hot Weather Concreting
ACI 318/318R	(1995) Building Code Requirements for Reinforced Concrete and Commentaries

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31	(1991) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1993) Concrete Aggregates
ASTM C 39	(1994) Compressive Strength of Cylindrical Concrete

	Specimens
ASTM C 42	(1994) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 78	(1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 94	(1995) Ready-Mixed Concrete
ASTM C 131	(1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1995a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 143	(1990a) Slump of Hydraulic Cement Concrete
ASTM C 150	(1995) Portland Cement
ASTM C 171	(1995) Sheet Materials for Curing Concrete
ASTM C 172	(1990) Sampling Freshly Mixed Concrete
ASTM C 173	(1994a) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 192	(1990a) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1991b) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1995) Air-Entraining Admixtures for Concrete
ASTM C 309	(1995) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 330	(1989) Lightweight Aggregates for Structural Concrete
ASTM C 494	(1992) Chemical Admixtures for Concrete
ASTM C 496	(1990) Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM C 552	(1991) Cellular Glass Thermal Insulation
ASTM C 567	(1991) Unit Weight of Structural Lightweight Concrete
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(1994) Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation

ASTM C 595	(1994a) Blended Hydraulic Cements
ASTM C 618	(1995) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C 685	(1995) Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C 881	(1990) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 937	(1980, R 1991) Grout Fluidifier for Preplaced-Aggregate Concrete
ASTM C 940	(1989) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM C 989	(1994a) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1017	(1992) Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1059	(1991) Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C 1064	(1986, R 1993) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1995b) Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1107	(1991a) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1116	(1991) Fiber-Reinforced Concrete and Shotcrete
ASTM C 1240	(1995) Silica Fume for Use in Hydraulic Cement Concrete and Mortar
ASTM D 75	(1987; R 1992) Sampling Aggregates
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM E 1155	(1987) Determining Floor Flatness and Levelness Using the F-Number System

CORPS OF ENGINEERS (COE)

COE CRD-C 94	(1995) Surface Retarders
COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete
COE CRD-C 540	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(1995) NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA TMMB-01	(1992) Truck Mixer Agitator and Front Discharge Concrete Carrier Standards of the Truck Mixer Manufacturers Bureau
NRMCA CPMB 100	(1990) Concrete Plant Standards
NRMCA QC 3	(1984) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

1.2 NOT USED

1.3 LUMP SUM CONTRACT

Under this type of contract concrete items will be paid for by lump sum and will not be measured. The work covered by these items consists of furnishing all concrete materials, reinforcement, miscellaneous embedded materials, and equipment, and performing all labor for the forming, manufacture, transporting, placing, finishing, curing, and protection of concrete in these structures.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-08 Statements

Mixture Proportions; GA.

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

SD-09 Reports

Testing and Inspection for Contractor Quality Control; GA.

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

SD-13 Certificates

Qualifications; FIO.

Written documentation for Contractor Quality Control personnel.

1.5 QUALIFICATIONS

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

Concrete Field Testing Technician, Grade I
Concrete Laboratory Testing Technician, Grade I or II
Concrete Construction Inspector, Level II

The foreman or lead journeyman of the flatwork finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation.

1.6 and 1.7 NOT USED

1.8 GENERAL REQUIREMENTS

1.8.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/A117R. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

1.8.1.1 Floors

For the purpose of this Section the following terminology correlation between ACI 117/A117R and this Section shall apply:

Floor Profile Quality Classification From ACI 117/A117R	This Section
Conventional Bullfloated	Same
Conventional Straightedged	Same
Flat	Float Finish or Trowel Finish

Levelness tolerance shall not apply where design requires floors to be sloped to drains or sloped for other reasons.

1.8.1.2 NOT USED

1.8.1.3 Floors by the Straightedge System

The flatness of the floors shall be carefully controlled and the tolerances shall be measured by the straightedge system as specified in paragraph 4.5.7 of ACI 117/A117R, using a 3 m straightedge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straightedge can be placed.

Trowel Finish 4 mm in 3m

1.8.2 Strength Requirements and w/c Ratio

1.8.2.1 Strength Requirements

Specified compressive strength (f'c) shall be as follows:

COMPRESSIVE STRENGTH	STRUCTURE OR PORTION OF STRUCTURE
27.5 MPa at 28 days	ALL CONCRETE

Concrete slabs on-grade shall have a 28-day flexural strength of 4.5 MPa. Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength for concrete made with Type I or II portland cement. Compressive strength shall be determined in accordance with ASTM C 39. Flexural strength shall be determined in accordance with ASTM C 78.

a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (152 by 305 mm cylinders) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'c and no individual test result falls below the specified strength f'c by more than 3.5 Mpa. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 3.5 Mpa or if tests of field-cured

cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.

c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318/318R. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

1.8.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be 0.45 by weight.

These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations of ACI 211.1 for the term P which is used to denote the weight of pozzolan.

1.8.3 Air Entrainment

Except as otherwise specified for lightweight concrete, all normal weight concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 19 mm or smaller it shall be between 4.5 and 7.5 percent. Concrete with specified strength over 35 Mpa may have 1.0 percent less air than specified above. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with ASTM C 231.

1.8.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143.

Structural Element	Slump Minimum	Slump Maximum
Walls, columns and beams	50 mm	100 mm
Foundation walls, substructure walls, footings, slabs	25 mm	75 mm

Any structural concrete approved for placement by pumping:		
At pump	50 mm	150 mm
At discharge of line	25 mm	100 mm

When use of a plasticizing admixture conforming to ASTM C 1017 or when a Type F or G high range water reducing admixture conforming to ASTM C 494 is permitted to increase the slump of concrete, concrete shall have a slump of50 to 100 mm before the admixture is added and a maximum slump of 200 mm at the point of delivery after the admixture is added.

1.8.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 32 degrees C. When the ambient temperature during placing is 5 degrees C or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 12 and 25 degrees C.

1.8.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

1.8.7 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

1.8.8 and 1.8.9 NOT USED

1.9 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

1.9.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Except as specified for flexural strength concrete, mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192 and tested in accordance with ASTM C 39. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in the paragraph Maximum Allowable w/c Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be

included in the equations in ACI 211.1 for the term P, which is used to denote the weight of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

1.9.2 and 1.9.3 NOT USED

1.9.4 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength (f'cr) exceeding the specified compressive strength (f'c) by the amount indicated below. This required average compressive strength, f'cr, will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below f'cr during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'cr, the mixture shall be adjusted, as approved, to bring the daily average back up to f'cr. During production, the required f'cr shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

1.9.4.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths (f'c) within 7 Mpa of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'cr used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

$$f'cr = f'c + 1.34S$$

$$f'cr = f'c + 2.33S - 500$$

Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16

20	1.08
25	1.03
30 or more	1.00

1.9.4.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength f'cr shall be determined as follows:

a. If the specified compressive strength f'c is less than 20 MPa,

f'cr = f'c + 6.9 MPa

b. If the specified compressive strength f'c is 20 to 35 MPa,

f'cr = f'c + 8.3 MPa

c. If the specified compressive strength f'c is over 35 MPa,

f'cr = f'c + 9.7 MPa

1.9.5 Average Flexural Strength Required for Mixtures

The mixture proportions selected during mixture design studies for flexural strength mixtures and the mixture used during concrete production shall be designed and adjusted during concrete production as approved, except that the overdesign for average flexural strength shall simply be 15 percent greater than the specified flexural strength at all times.

1.9.6 NOT USED

1.10 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

1.11 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

1.11.1 Materials

The contractor will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of

aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

1.11.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

1.11.3 Hardened Concrete

Tests on hardened concrete may be requested by the Government when such tests are considered necessary. These tests
will be performed by the contractor if required.

1.11.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement or portland-pozzolan cement, or portland cement in combination and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

2.1.1 Portland Cement

ASTM C 150, Type I low alkali with a maximum 15 percent amount of tricalcium aluminate, or Type II.

2.1.2 NOT USED

2.1.3 Blended Cements

ASTM C 595, Type IP or IS

2.1.4 Pozzolan (Fly Ash)

ASTM C 618, Class F with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of ASTM C 618. Requirement for maximum alkalies from Table 1A of ASTM C 618 shall apply. If pozzolan is used, it shall never be less than 15 percent nor more than 35 percent by weight of the total cementitious material.

2.1.5 and 2.1.6 NOT USED

2.2 AGGREGATES

Aggregates shall conform to the following.

2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33. Fine Aggregate for building concrete shall be natural river sand

2.2.2 Coarse Aggregate

Coarse aggregate shall conform to KDOT #57's.

2.2.3 and 2.2.4 NOT USED

2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.3.1 Air-Entraining Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

2.3.2 Accelerating Admixture

ASTM C 494, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

2.3.3 Water-Reducing or Retarding Admixture

ASTM C 494, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

2.3.4 High-Range Water Reducer

ASTM C 494, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.3.5 Surface Retarder

COE CRD-C 94.

2.3.6 Expanding Admixture

Aluminum powder type expanding admixture conforming to ASTM C 937.

2.3.7 Other Chemical Admixtures

Chemical admixtures for use in producing flowing concrete shall comply with ASTM C 1017, Type I or II. These admixtures shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.4 CURING MATERIALS

NOTE: Concrete deck topping on the Soldier Community Building Patio shall be cured in accordance with
Section 2.4.3.

2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

2.4.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

2.4.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

2.6 NONSHRINK GROUT

Nonshrink grout shall conform to ASTM C 1107, GradeA, and shall be a commercial formulation suitable for the proposed application.

2.7 NONSLIP SURFACING MATERIAL

Nonslip surfacing material shall consist of 55 percent, minimum, aluminum oxide or silicon-dioxide abrasive ceramically bonded together to form a homogeneous material sufficiently porous to provide a good bond with portland cement paste; or factory-graded emery aggregate consisting of not less than 45 percent aluminum oxide and 25 percent ferric oxide. The aggregate shall be well graded from particles retained on the 0.600 mm sieve to particles passing the 2.36 mm.

2.8 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to ASTM C 1059.

2.9 EPOXY RESIN

Epoxy resins for use in repairs shall conform to ASTM C 881, Type V, Grade 2. Class as appropriate to the existing ambient and surface temperatures.

2.10 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel. Hangers for suspended ceilings shall be as specified in Section 09510 ACOUSTICAL CEILINGS. Inserts for shelf angles and bolt hangers shall be of malleable iron or cast or wrought steel.

2.11 NOT USED

2.12 PERIMETER INSULATION

Perimeter insulation shall be polystyrene conforming to ASTM C 578, Type II; polyurethane conforming to ASTM C 591, Type II; or cellular glass conforming to ASTM C 552, Type I or IV.

2.13 VAPOR BARRIER

Vapor barrier shall be polyethylene sheeting with a minimum thickness of 0.15 mm (6 mils) or other equivalent material having a vapor permeance rating not exceeding 30 nanograms per Pascal per second per square meter (0.5 perms) as determined in accordance with ASTM E 96.

2.14 JOINT MATERIALS

2.14.1 Joint Fillers, Sealers, and Waterstops

Expansion joint fillers shall be preformed materials conforming to ASTM D 1751. Materials for waterstops shall be in accordance with Section 03250 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS. Materials for and sealing of joints shall conform to the requirements of Section 07920 JOINT SEALING.

2.14.2 Contraction Joints in Slabs

Sawable type contraction joint inserts shall conform to COE CRD-C 540. Nonsawable joint inserts shall have sufficient stiffness to permit placement in plastic concrete without undue deviation from a straight line and shall conform to the physical requirements of COE CRD-C 540, with the exception of Section 3.4 "Resistance to Sawing". Plastic inserts shall be polyvinyl chloride conforming to the materials requirements of COE CRD-C 572.

2.15 and 2.16 NOT USED

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section 03100 STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section 03200 CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.1.1 Foundations
3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

3.1.1.2 Preparation of Rock

Rock surfaces upon which concrete is to be placed shall be free from oil, standing or running water, ice, mud, drummy rock, coating, debris, and loose, semidetached or unsound fragments. Joints in rock shall be cleaned to a satisfactory depth, as determined by the Contracting Officer, and to firm rock on the sides. Immediately before the concrete is placed, rock surfaces shall be cleaned thoroughly by the use of air-water jets or sandblasting as specified below for Previously Placed Concrete. Rock surfaces shall be kept continuously moist for at least 24 hours immediately prior to placing concrete thereon. All horizontal and approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar proportioned similar to that in the concrete mixture. Concrete shall be placed before the mortar stiffens.

3.1.1.3 Excavated Surfaces in Lieu of Forms

Concrete for footings may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section 02221 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances.

3.1.2 NOT USED

3.1.3 Vapor Barrier

Vapor barrier shall be provided beneath the interior on-grade concrete floor slabs. The greatest widths and lengths practicable shall be used to eliminate joints wherever possible. Joints shall be lapped a minimum of 300 mm. Torn, punctured, or damaged vapor barrier material shall be removed and new vapor barrier shall be provided prior to placing concrete. For minor repairs, patches may be made using laps of at least 300 mm. Lapped joints shall be sealed and edges patched with pressure-sensitive adhesive or tape not less than 50 mm wide and compatible with the membrane. Vapor barrier shall be placed directly on underlying subgrade, base course, or capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier. In this case, the surface shall be choked with a light layer of sand, as approved, before placing the vapor barrier. Concrete placement shall be controlled so as to prevent damage to the vapor barrier, or any covering sand.

3.1.4 Perimeter Insulation

Perimeter insulation shall be installed at locations indicated. Adhesive shall be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

3.1.5 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 600 mm of the surface of the concrete. Tack welding shall not be performed on or to embedded items.

3.2 CONCRETE PRODUCTION

3.2.1 Batching, Mixing, and Transporting Concrete

Concrete shall either be batched and mixed onsite or shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB-01. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete.

3.2.1.1 General

The batching plant shall be located off site close to the project. The batching, mixing and placing system shall have a capacity of at least 50 cubic meters per hour. The batching plant shall conform to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required.

3.2.1.2 Batching Equipment

The batching controls shall be semiautomatic or automatic, as defined in NRMCA CPMB 100. A semiautomatic batching system shall be provided with interlocks such that the discharge device cannot be actuated until the indicated material is within the applicable tolerance. The batching system shall be equipped with accurate recorder or recorders that meet the requirements of NRMCA CPMB 100. The weight of water and admixtures shall be recorded if batched by weight. Separate bins or compartments shall be provided for each size group of aggregate and type of cementitious material, to prevent intermingling at any time. Aggregates shall be weighed either in separate weigh batchers with individual scales or, provided the smallest size is batched first, cumulatively in one weigh batcher on one scale. Aggregate shall not be weighed in the same batcher with cementitious material. If both portland cement and other cementitious material are used, they may be batched cumulatively, provided that the portland cement is batched first, except that silica fume shall always be batched separately. Water may be measured by weight or volume. Water shall not be weighed or measured cumulatively with another ingredient. Filling and discharging valves for the water metering or batching system shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. Piping for water and for admixtures shall be free from leaks and shall be properly valved to prevent backflow or siphoning. Admixtures shall be furnished as a liquid of suitable concentration for easy control of dispensing. An adjustable, accurate, mechanical device for measuring and dispensing each admixture shall be provided. Each admixture dispenser shall be interlocked with the batching and discharging operation of the water so that each admixture is separately batched and individually discharged automatically in a manner to obtain uniform distribution throughout the water as it is added to the batch in the specified mixing period. When use of truck mixers makes this requirement impractical, the admixture dispensers shall be interlocked with the sand batchers. Different admixtures shall not be combined prior to introduction in water and shall not be allowed to intermingle until in contact with the cement. Admixture dispensers shall have suitable devices to detect and indicate flow during dispensing or have a means for visual observation. The plant shall be arranged so as to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of aggregates from each bin or compartment, and for sampling and calibrating the dispensing of cementitious material, water, and admixtures. Filling ports for cementitious materials bins or silos shall be clearly marked with a permanent sign stating the contents.

3.2.1.3 Scales

The weighing equipment shall conform to the applicable requirements of CPMB Concrete Plant Standard, and of NIST HB 44, except that the accuracy shall be plus or minus 0.2 percent of scale capacity. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking

the operating performance of each scale or other measuring devices. The tests shall be made at the specified frequency in the presence of a Government inspector. The weighing equipment shall be arranged so that the plant operator can conveniently observe all dials or indicators.

3.2.1.4 Batching Tolerances

(A) Tolerances with Weighing Equipment

MATERIAL	PERCENT OF REQUIRED WEIGHT
Cementitious materials	0 to plus 2
Aggregate	plus or minus 2
Water	plus or minus 1
Chemical admixture	0 to plus 6

(B) Tolerances with Volumetric Equipment

For volumetric batching equipment used for water and admixtures, the following tolerances shall apply to the required volume of material being batched:

MATERIAL	PERCENT OF REQUIRED MATERIAL
Water:	plus or minus 1 percent
Chemical admixtures:	0 to plus 6 percent

3.2.1.5 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched.

3.2.1.6 Concrete Mixers

Mixers shall be stationary mixers or truck mixers. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired.

3.2.1.7 Stationary Mixers

Concrete plant mixers shall be drum-type mixers of tilting, nontilting, horizontal-shaft, or vertical-shaft type, or shall be pug mill type and shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. The mixing time and uniformity shall conform to all the requirements in ASTM C 94 applicable to central-mixed concrete.

3.2.1.8 Truck Mixers

Truck mixers, the mixing of concrete therein, and concrete uniformity shall conform to the requirements of ASTM C 94. A truck mixer may be used either for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer (shrink-mixed). Each truck shall be equipped with two counters from which it is possible to determine the number of revolutions at mixing speed and the number of

revolutions at agitating speed. Or, if approved in lieu of this, the number of revolutions shall be marked on the batch tickets. Water shall not be added at the placing site unless specifically approved; and in no case shall it exceed the specified w/c. Any such water shall be injected at the base of the mixer, not at the discharge end.

3.3 thru 3..5 NOT USED

3.6 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in truck mixers, or by approved pumping equipment conveyors. Nonagitating equipment, other than pumps, shall not be used for transporting lightweight aggregate concrete.

3.7 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

3.7.1 Buckets

The interior hopper slope shall be not less than 58 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 0.2 square meters. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 1.5 cubic meters shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

3.7.2 Transfer Hoppers

Concrete may be charged into nonagitating hoppers for transfer to other conveying devices. Transfer hoppers shall be capable of receiving concrete directly from delivery vehicles and shall have conical-shaped discharge features. The transfer hopper shall be equipped with a hydraulically operated gate and with a means of external vibration to effect complete discharge. Concrete shall not be held in nonagitating transfer hoppers more than 30 minutes.

3.7.3 Trucks

Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94. Nonagitating equipment shall be used only for transporting plant-mixed concrete over a smooth road and when the hauling time is less than 15 minutes. Bodies of nonagitating equipment shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

3.7.4 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

3.7.5 Belt Conveyors

Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means, such as discharge baffle or hopper , for preventing segregation of the concrete at the transfer points and the point of placing. Belt conveyors shall be constructed such that the idler spacing shall not exceed 900 mm. The belt speed shall be a minimum of 90 meters per minute and a maximum of 225 meters per minute. If concrete is to be placed through installed horizontal or sloping reinforcing bars, the conveyor shall discharge concrete into a pipe or elephant truck that is long enough to extend through the reinforcing bars.

3.7.6 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 100 mm. Aluminum pipe shall not be used.

3.8 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 30 degrees C, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

3.8.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 1.5 meters except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 300 mm thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

3.8.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 100 mm thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.6 mm, and the head diameter shall be appropriate for the structural member and

the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 150 mm into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 100 mm and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

3.8.3 Cold Weather Requirements

Special protection measures, approved by the Contracting Officer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 5 degrees C. The temperature of the concrete when placed shall be not less than 10 degrees C nor more than 25 degrees C. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C 494, Type C or E may be used, provided it contains no calcium chloride. Calcium chloride shall not be used.

3.8.4 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 30 degrees C, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 49 degrees C. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature Degrees
Greater than 60	33 C
40-60	30 C
Less than 40	27 C

3.8.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of

Fig. 2.1.5 of ACI 305R. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.8.6 thru 3.8.8 NOT USED

3.9 JOINTS

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 50 mm clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 1.5 kg per square meter asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated and in accordance with Section 07920 JOINT SEALING.

3.9.1 Construction Joints

For concrete other than slabs on grade, construction joints shall be located so that the unit of operation does not exceed 15 meters Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, a strip of 25 mm square-edge lumber, bevelled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 25 mm above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

3.9.2 Contraction Joints in Slabs on Grade

Contraction joints shall be located and detailed as shown on the drawings. Contraction Joints shall be produced by forming a weakened plane in the concrete slab by use of rigid inserts impressed in the concrete during placing operations use of snap-out plastic joint forming inserts or sawing a continuous slot with a concrete saw. Regardless of method used to produce the weakened plane, it shall be 1/4 the depth of the slab thickness and between 3 and 5 mm wide. For saw-cut joints, cutting shall be timed

properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent ravelling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Reservoir for joint sealant shall be formed as previously specified.

3.9.3 Expansion Joints

Installation of expansion joints and sealing of these joints shall conform to the requirements of Section 03250 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS and Section 07920 JOINT SEALING.

3.9.4 Waterstops

Waterstops shall be installed in conformance with the locations and details shown on the drawings using materials and procedures specified in Section 03250 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

3.9.5 Dowels and Tie Bars

Dowels and tie bars shall be installed at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section 03200 CONCRETE REINFORCEMENT and herein. Conventional smooth "paving" dowels shall be installed in slabs using approved methods to hold the dowel in place during concreting within a maximum alignment tolerance of 1 mm in 100 mm. "Structural" type deformed bar dowels, or tie bars, shall be installed to meet the specified tolerances. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

3.10 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section 03100 STRUCTURAL CONCRETE FORMWORK. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class A or B finish. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/A117R. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract and, for Class A and B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

3.10.1 Class A Finish and Class B Finish

Class B finish is required where indicated on the drawings in the following areas where foundation or concrete are exposed to view. Fins, ravelings, and loose material shall be removed, all surface defects over 12 mm in diameter or more than 12 mm, shall be repaired and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Defects more than 12 mm in diameter shall be cut back to sound concrete, but in all cases at least 25 mm deep. The Contractor shall prepare a sample panel for approval (as specified in PART 1) before commencing repair, showing that the surface texture and color match will be attained. Metal tools shall not be used to finish repairs in Class A surfaces.

3.10.2 Class C and Class D Finish

Class C finish is required in the following areas, where concrete is not exposed to view. Class D finish is required where indicated on the drawings. in the following areas, where concrete is not exposed to view. Fins, ravelings, and loose material shall be removed, and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 12 mm deep or more than 50 mm in diameter shall be repaired. Defects more than 50 mm in diameter shall be cut back to sound concrete, but in all cases at least 25 mm deep.

3.10.3 NOT USED

3.11 REPAIRS

3.11.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 100 mm shall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the 1.18 mm, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

3.11.2 Repair of Major Defects

Major defects will be considered to be those more than 12 mm deep or, for Class A and B finishes, more than 12 mm in diameter and, for Class C and D finishes, more than 50 mm in diameter. Also included are any defects of any kind whose depth is over 100 mm or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

3.11.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 50 mm on all sides. All such defective areas greater than 7800 square mm shall be outlined by saw cuts at least 25 mm deep. Defective areas less than 7800 square mm shall be outlined by a 25 mm deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high

pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

3.11.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 150 mm deep and also have an average diameter at the surface
more than 450 mm or that are otherwise so identified by the Project Office. Such defects shall be repaired as specified herein or directed, except that defects which affect the strength of the structure shall not be repaired and that portion of the structure shall be completely removed and replaced. Deep and large defects shall be repaired by procedures approved in advance including forming and placing special concrete using applied pressure during hardening. Preparation of the repair area shall be as specified for surface application of mortar. In addition, the top edge (surface) of the repair area shall be sloped at approximately 20 degrees from the horizontal, upward toward the side from which concrete will be placed. The special concrete shall be a concrete mixture with low water content and low slump, and shall be allowed to age 30 to 60 minutes before use. Concrete containing a specified expanding admixture may be used in lieu of the above mixture; the paste portion of such concrete mixture shall be designed to have an expansion between 2.0 and 4.0 percent when tested in accordance with ASTM C 940. A full width "chimney" shall be provided at the top of the form on the placing side to ensure filling to the top of the opening. A pressure cap shall be used on the concrete in the chimney with simultaneous tightening and revibrating the form during hardening to ensure a tight fit for the repair. The form shall be removed after 24 hours and immediately the chimney shall be carefully chipped away to avoid breaking concrete out of the repair; the surface of the repair concrete shall be dressed as required.

3.11.3 NOT USED

3.12 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in PART 1, when tested as specified herein.

3.12.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 10 degrees C. In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with

additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

3.12.2 and 3.12.3 NOT USED

3.12.4 Troweled Finish

The following areas, slab on grade and second and third floor slabs shall be given a trowel finish. After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. Additional trowelings shall be performed, either by hand or machine until the surface has been troweled 3 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

3.12.5 NOT USED

3.12.6 Non-Slip Finish

Non-slip floors shall be constructed in accordance with the following subparagraphs.

3.12.6.1 Broomed

The following areas sidewalks shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a coarse fiber push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab. After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

3.12.6.2 NOT USED

3.12.7 and 3.12.8 NOT USED

3.12.8.1 General

Heavy duty floor shall be constructed by placing a heavy duty bonded topping on a base slab which has had a rough slab finish left 50 mm below final grade. Concrete in the base slab shall be thoroughly

hardened but not more than 30 hours old. The temperature of the fresh concrete topping shall not vary more than 5 degrees C plus or minus from the temperature of the base slab. The ambient temperature of the space adjacent to the concrete placement and of the base slab shall be between 10 and 30 degrees C.

3.12.8.2 Preparation of Base Slab

The base slab shall be kept continuously damp until topping is placed. The surface of the base slab shall be thoroughly cleaned with an air-water jet immediately before placing the topping. A thin coat of neat cement grout of about the consistency of thick cream shall be thoroughly scrubbed into the existing surface immediately ahead of the overlay placing. At the time the neat cement grout is placed, the existing concrete surface shall be damp but shall have no free water present. The overlay concrete shall be deposited before the grout coat has had time to stiffen.

3.12.8.3 Placing and Finishing

Concrete shall be placed, as nearly as practicable in final position, in a uniform layer. The overlay shall be placed and screeded slightly above the required finished grade, compacted by rolling with rollers weighing not less than 4.5 kg per 25 mm of roller width or by approved tamping equipment and finish screeded to established grade. Grid type tampers shall not be used. The concrete, while still green but sufficiently hardened to bear a person's weight without deep imprint, shall be floated to a true even plane with no coarse aggregate visible. Floating shall be performed with an approved disc-type mechanical float which has integral impact mechanism. The surface of the overlay shall then be left undisturbed until the concrete has hardened enough to prevent excess fines from being worked to the top. Joints shall be formed to match those in the base slab.

3.12.8.4 Curing and Protection

Concrete shall be maintained in a moist condition and shall be protected against rapid temperature change, mechanical injury, and injury from rain or flowing water, for a curing period of not less than 10 days. Concrete shall be maintained in a moist condition at temperatures above 10 and below 30 degrees C throughout the specified curing period. Concrete shall be protected from a temperature change greater than 3 degrees C per hour and from rapid drying for the first 24 hours following the removal of temperature protection. Curing activities shall begin as soon as free water has disappeared from the concrete surface after placing and finishing. Curing shall be moist curing accomplished by the following method. Surfaces shall be covered with a double layer of burlap, wetted before placing, and overlapped at least 150 mm. Burlap shall be kept continually wet and in intimate contact with the surface. Burlap shall be kept covered with a polyethylene sheeting at least 0.1 mm thick. All traffic shall be kept from the floor during the curing period and heavy traffic shall be kept off till 28-day age.

3.12.9 NOT USED

3.13 NOT USED

3.14 NOT USED

3.15 CURING AND PROTECTION

3.15.1 General

Concrete shall be cured by an approved method for the period of time given below:

Concrete with Type III cement	3 days
All other concrete	7 days

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above 10 degrees C for the first 3 days and at a temperature above 0 degrees C for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded. Concrete containing silica fume shall be initially cured by fog misting during finishing, followed immediately by continuous moist curing. Except for plastic coated burlap, impervious sheeting alone shall not be used for curing.

3.15.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

3.15.3 Membrane Forming Curing Compounds

Membrane forming curing compounds shall be used only on surfaces in the following areas, everywhere except the Solider Community Concrete Patio Deck. Concrete in the following areas. Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete, including surfaces to which a smooth finish is to be applied or other concrete to be bonded. However, a styrene acrylate or chlorinated rubber compound meeting ASTM C 309, Class B requirements, may be used for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. All surfaces shall be thoroughly moistened with water. Curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 500 kPa at a uniform coverage of not more than 10 cubic meter per for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. Surfaces on which clear compound is used shall be shaded from direct rays of the sun for the first 3 days. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

3.15.4 NOT USED

3.15.5 Ponding or Immersion

Concrete shall be continually immersed throughout the curing period. Water shall not be more than 10 degrees C less than the temperature of the concrete.

3.15.6 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 0 degrees C the temperature of the concrete shall be maintained above 5 degrees C for the first seven days after placing. During the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 13 degrees C as determined by suitable temperature measuring devices furnished by the Government, as required, and installed adjacent to the concrete surface and 50 mm inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor as directed.

3.16 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation with damp-pack bedding mortar, except where nonshrink grout is indicated. The thickness of the mortar or grout shall be approximately 1/24 the width of the plate, but not less than 20 mm. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed.

3.16.1 Damp-Pack Bedding Mortar

Damp-pack bedding mortar shall consist of 1 part cement and 2-1/2 parts fine aggregate having water content such that a mass of mortar tightly squeezed in the hand will retain its shape but will crumble when disturbed. The space between the top of the concrete and bottom of the bearing plate or base shall be packed with the bedding mortar by tamping or ramming with a bar or rod until it is completely filled.

3.16.2 Nonshrink Grout

Nonshrink grout shall be a ready-mixed material requiring only the addition of water. Water content shall be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

3.16.2.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified therein. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, the batch shall be mixed for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. The space between the top of the concrete or machinery-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for completely retaining the grout on all sides and on top and shall be removed after the grout has set. The placed grout shall be carefully worked by rodding or other means to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be retempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces receiving the grout, shall be maintained at 18 to 30 degrees C until after setting.

3.16.2.2 Treatment of Exposed Surfaces

For metal-oxidizing nonshrink grout, exposed surfaces shall be cut back 25 mm and immediately covered with a parge coat of mortar consisting of 1 part portland cement and 2-1/2 parts fine aggregate by weight, with sufficient water to make a plastic mixture. The parge coat shall have a smooth finish. For other mortars or grouts, exposed surfaces shall have a smooth-dense finish and be left untreated. Curing shall comply with paragraph CURING AND PROTECTION.

3.17 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with ASTM C 1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per 12 months thereafter for conformance with ASTM C 1077.

3.17.1 Grading and Corrective Action

3.17.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with ASTM C 136 and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall immediately reported to the Contracting Officer, concreting shall be stopped, and immediate steps taken to correct the grading.

3.17.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C 136 for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and shall be reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

3.17.2 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests for aggregate quality required by ASTM C 33. In addition, after the start of concrete placement, the Contractor shall perform tests for aggregate quality at least every three months, and when the source of aggregate or

aggregate quality changes. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

3.17.3 Scales, Batching and Recording

The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every three months. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, the Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

3.17.4 Batch-Plant Control

The measurement of concrete materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate weights and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic meter, amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic meter for each class of concrete batched during each day's plant operation.

3.17.5 Concrete Mixture

a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with ASTM C 231 for normal weight concrete and ASTM C 173 for lightweight concrete. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph Air Entrainment. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the air content at the mixe controlled as directed.

b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture

batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good reproducibility. Whenever a point on either control chart reaches an action limit line, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted.

c. Slump Testing. In addition to slump tests which shall be made when test specimens are fabricated, at least four slump tests shall be made on randomly selected batches in accordance with ASTM C 143 for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Limits shall be set on separate control charts for slump for each type of mixture. The upper warning limit shall be set at 12.5 mm below the maximum allowable slump specified in paragraph Slump in PART 1 for each type of concrete and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 50 mm. Samples for slump shall be taken at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an adjustment shall immediately be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, the concreting operation shall immediately be halted, and the Contractor shall take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.

e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064. The temperature shall be reported along with the compressive strength data.

f. Strength Specimens. At least one set of test specimens shall be made, for compressive or flexural strength as appropriate, for every 250 cubic meters placed, or at least one test per day on each different class of concrete mixture placed. See Section 02515 Para. 3.13.2.1.2 for Concrete Pavement testing requirements. Additional sets of test specimens shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A truly random (not haphazard) sampling plan shall be developed by the Contractor and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength per paragraph Strength Requirements in PART 1 shall consist of four specimens, two to be tested at 7 days and two at 28 days. Test specimens shall be molded and cured in accordance with ASTM C 31 and tested

in accordance with ASTM C 39 for test cylinders and ASTM C 78 for test beams. Results of all strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in parargraph Strength Requirements in PART 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in ACI 214.3R.

3.17.6 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.17.7 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

3.17.8 Vibrators

The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing. Any vibrator not meeting the requirements of paragraph Consolidation, shall be immediately removed from service and repaired or replaced.

3.17.9 Curing Inspection

a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.

b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.

c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the Contractor shall estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, shall compute the rate of coverage in square meters per Liter,and shall note whether or not coverage is uniform.

d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

e. Sheet Curing Inspection. At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.

f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

3.17.10 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.17.11 Mixer Uniformity

a. Stationary Mixers. Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 60,000 cubic meters of concrete placed, whichever results in the shortest time interval, uniformity of concrete mixing shall be determined in accordance with ASTM C 94.

b. Truck Mixers. Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.

c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

3.17.12 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION CONCRETE FOR BUILDING CONSTRUCTION				CONTRACTOR										SPEC. SECTION 03300
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
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SECTION 03451

CAST STONE
02/9

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SECTION 03451

CAST STONE
02/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 315	(1992) ACI Detailing Manual: Section Details and Detailing of Concrete Reinforcement
ACI 318/318R	(1995) Building Code Requirements for Reinforced Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 615	(1996) Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement
ASTM C 33	(1997) Specification for Concrete Aggregates
ASTM C 150	(1995; Rev A) Specification for Portland Cement
ASTM C 494	(1992) Specification for Concrete Admixtures
ASTM C 979 Stonr	(1982) Specification for Coloring Pigments for Integrally Pigmented Concrete
ASTM C 1194	(1991) Test Method for Compressive Strength of Architectural Cast Stone
ASTM C 1195	(1991) Test Method for Absorption of Architectural Cast Stone
ASTM C-1364	(1997) Standard Specification for Architectural cast Stone
ASTM D 2244	(1993) Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates

CAST STONE INSTITUTE

CSITM	Cast Stone Institute Technical Manual

1.2 GENERAL ELEMENTS

Cast stone units shall be designed and fabricated by an experienced and acceptable cast stone manufacturer. The manufacturer shall have been regularly and continuously engaged in the manufacture of precast concrete work similar to that indicated on the drawings for at least 5 years. Precast work shall be coordinated with the work of other trades.

1.3 DESIGN

1.3.1 Standards and Loads

Cast stone unit design shall conform to ASTM C 1194. Design loads for cast stone shall be as indicated on the drawings. Stresses due to restrained volume change caused by shrinkage and temperature differential, handling, transportation and erection shall be accounted for in the design.

1.3.2 Connections

Connection of units to other members, or to other units shall be as recommended by the manufacturer. The design and sizing of connections for all design loads shall be by the Contractor.

1.3.3 Cast Stone Strength

Cast stone units shall have a 28-day compressive strength of 40 MPa.

1.3.4 Calculations

Calculations for design of members and connections not shown shall be made by a professional engineer experienced in the design of cast stone. Calculation shall include the analysis of member for lifting stresses and the sizing of the lifting inserts.

1.3.5 Absorption

In accordance with ASTM C 1195 and ASTM C 642 with a maximum of 6% for products at 28 days.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Calculations; FIO.

Design calculations, prior to the manufacture of any cast stone units for the project.

Mix Design; FIO.

A statement giving the maximum nominal coarse aggregate size, detailed description of the curing method, the proportions of all ingredients and the type and amount of any admixtures that will be used in the manufacture of each strength and type of cast stone units, prior to commencing operations. The statement shall be accompanied by test results from an approved testing laboratory, certifying that the proportions selected will produce concrete of the properties required. No substitutions shall be made without additional tests to verify that the concrete properties are satisfactory.

SD-04 Drawings

Architectural Concrete System; GA.

Detail drawings showing details in accordance with ACI 315 and ACI 318/318R, including installation details. Detail drawings shall indicate separate identification marks for each different cast stone unit, location of units in the work, elevations, cross sections, fabrication details, reinforcement, anchoring methods, anchors, connections, dimensions, interface with adjacent members, blocking points for units stored at the cast stone concrete plant or at the jobsite, lifting points and special handling instructions in sufficient detail to cover manufacture, handling, and erection.

SD-09 Reports

Materials; FIO.

Certified copies of test reports including all test data and all test results. Tests for compressive strength of concrete shall be performed by an approved independent commercial testing laboratory, except that compressive strength tests for initial prestress may be performed in the manufacturer's plant laboratory.

SD-14 Samples

Cast Stone Units; GA.

Two 300 mm by 300 mm by 50 mm samples of each type of cast stone unit finish required for the project. Samples shall show matrix color, surface color, surface texture, and panel back finish.

SD-18 Records

Manufacturer's Qualifications; FIO.

A statement giving the qualifications of the precast concrete manufacturer and of the installers, prior to commencing operations.

1.5 STORAGE AND INSPECTION AT MANUFACTURER'S PLANT

Cast stone units temporarily stored at the manufacturer's plant shall be protected from damage. Immediately prior to shipment to the jobsite, all cast stone units shall be inspected for quality to insure all cast stone units conform to the requirements specified. Inspection for quality will include but not necessarily be limited to the following elements; color, texture, dimensional tolerances, chipping, cracking, staining, warping and honeycombing. All defective cast stone units shall be replaced or repaired as approved.

1.6 HANDLING AND STORAGE

Cast stone units shall be delivered, unloaded and stored on the site only by the installation contractor. Schedule the delivery to avoid excessive build-up of units in storage at the site. Upon delivery to the jobsite all cast stone units shall be inspected for quality as specified in paragraph STORAGE AND INSPECTION AT MANUFACTURER'S PLANT. If the cast stone units cannot be unloaded and placed directly into the work, they shall be stored on site, off the ground and protected from weather, marring, or overload. Cast stone units shall be handled in accordance with manufacturer's instructions.

1.7 QUALIFICATIONS

The Cast Stone manufacturer shall meet the minimum standards of the Cast Stone Institute Technical Manual (current edition) and be responsible for all the labor, material and services incidental to furnishing all Cast Stone as indicated on the drawings and specifications.

PART 2 PRODUCTS

2.1 MATERIALS

Except as otherwise specified, material shall conform to the following;

2.1.1. Aggregates

2.1.1.1 Coarse aggregates shall consist of granite, quartz or limestone, ASTM C 33, except for gradation.

2.1.1.2 Fine aggregates shall consist of manufactured or natural sands, ASTM C 33, except for gradation.
Coarse

2.1.2 Portland Cement

Type I or III, white or grey, ASTM C 150.

2.1.3 Colors

Inorganic iron oxide pigments, ASTM C979.

2.1.4 Inserts

Inserts shall be manufacturer's standard, suited for the application.

2.1.5 Plates, Angles, Anchors and Embedments

Steel items, including items embedded in concrete, shall be either stainless steel or hot dip galvanized steel.

2.1.6 Water

Water shall be clean and potable.

2.1.7 Admixtures

Admixtures shall conform to ASTM C 494.

2.1.8 Mortar

Mortar shall be type N, ASTM C 270.

2.1.9 Reinforcement

Steel reinforcing shall comply with ASTM A 615, grade 40 or 60. Reinforcing bars shall be deformed galvanized or epoxy coated when covered with less than 38 mm of material. Reinforce units when necessary for handling or structural stresses. Area of reinforcement in the stone units shall not be less than 1/4 of one percent of the cross sectional area and otherwise as required by ACI 318.

2.2 Embedded Accessories

Anchors, inserts, lifting devices, and other accessories which are to be embedded in the precast units shall be furnished and installed in accordance with the approved detail drawings. Embedded items shall be accurately positioned in their designed location, and shall have sufficient anchorage and embedment to satisfy design requirements.

2.3 Identification

Each cast stone unit shall be marked to correspond to the identification marks for each different cast stone unit shown on the detail drawings.

2.4 Finishes

Match sample as submitted and approved. No bugholes or air voids will be permitted.

2.4.1 Exposed Surfaces

Surfaces of cast stone units exposed to view or surfaces indicated to be finished shall be a fine grained texture similar to that of natural stone.

2.4.2 Other Surfaces

Surfaces of cast stone units not exposed to view or not otherwise indicated to be finished shall receive the manufacturer's standard finish.

2.5 Color

Color shall follow ASTM D 2244 with color variation allowed of 2% hue and 6% lightness.

2.6 Curing

Cure cast stone units in a warm, moist curing chamber at 95% relative humidity for 24 hours, or yard cure for 350 degree days prior to shipment. Acid-etch exposd surfaces to remove cement film prior to packaging for shipment.

2.7 Mortar Screen

Provide 25 mm thick high density polyethylene mortar screen at base of wall between the insulation and cast stone to suspend mortar droppings in a manner to allow cavity moisture to drain through the weep holes.

2.8 Cast Stone Profile

Each cast stone unit shall follow the profile as indicated on the approved detail drawings. Drip groves shall be placed on underside of units overhanging walls and balconies.

PART 3 EXECUTION

3.1 ERECTION

Cast stone units shall be erected in accordance with the detail drawings and without damage to other units or to adjacent members. Drench stone units with clear water just prior to setting. Units shall be set true to alignment and level, with joints properly spaced and aligned both vertically and horizontally. Erection tolerances shall be in accordance with the requirements of Cast Stone Institute Technical Manual. As units are being erected, shims and wedges shall be placed as required to maintain correct alignment. After final attachment, cast stone units shall be grouted as shown. Fill all dowel holes and anchor slots completely with mortar or non-shrink grout. After erection, welds and abraded surfaces of steel shall be cleaned and touched-up with a zinc-rich paint. Pickup points, boxouts, inserts, and the like shall be finished to match adjacent areas after erection. Erection of cast stone units shall be supervised and performed by workmen skilled in this type of work.

3.1.1 Weep Holes

Weep hole ropes shall be provided at cast stone panel joints of 1435 mm on centers.

3.1.2 Mortar Screen

Install continuous mortar screen with dovetail side up at base of wall between the insulation and cast stone to divert moisture out of the cavity and toward the weep holes.

3.2 JOINTS

3.2.1. Joint Material

Use full bed of mortar at all bed joints. Flush verticle joints full with mortar. Leave all joints with exposed tops or under shelf angles open for sealant. Coordinate sealant with Sealant section 7920.

3.2.2. Jointing Size

Cast stone joints at brick; 10 mm.
Cast stone joints at stone in verticle position; 6 mm.

Cast stone joints at stone and exposed on top side; 10 mm.

3.3 CLEANING

Cast stone units shall be cleaned to remove dirt and stains by dry scrubbing with a stiff fiber brush, wetting the surface and vigorous scrubbing of the finish with a stiff fiber brush followed by additional washing, or by chemical cleaning compounds such as detergents or other commercial cleaners. Commercial cleaners shall be used in accordance with the manufacturer's recommendations. Cleaning procedure shall be performed on a designated test area and shall be approved prior to proceeding with cleaning work. Discolorations which cannot be removed by these procedures, shall be considered defective work. Cleaning work shall be done when temperature and humidity conditions are such that surfaces dry rapidly. Care shall be taken during cleaning operations to protect adjacent surfaces from damage.

3.4 PROTECTION OF WORK

Cast stone units shall be protected against damage from subsequent operations.

3.5 DEFECTIVE WORK

Cast stone units damaged during erection shall be repaired as soon after occurrence as possible or replaced, as directed, using approved procedures. All repairs to cast stone units shall match the adjacent surfaces in color and texture and shall be as approved.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 03451
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.4 SUBMITTALS										
			SD-01 Data										
		1	Calculations; FIO.										
		2	Mix Design; FIO.										
			SD-04 Drawings										
		3	Architectural Concrete System; GA.										
			SD-09 Reports										
		4	Materials; FIO.										
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SAFETY PAYS

***** SAFETY PAYS *****

SECTION 03550

PRECAST/PRESTRESSED CONCRETE FLOOR AND ROOF UNITS

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SECTION 03550

PRECAST/PRESTRESSED CONCRETE FLOOR AND ROOF UNITS

03/89

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318/318R	(1989; Rev 1992; Errata) Building Code Requirements for Reinforced Concrete

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1994) Structural Welding Code - Steel

PRECAST PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI Mnl-116	(1985) Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products
PCI Mnl-120	(1992) PCI Design Handbook - Precast and Prestressed Concrete

1.2 GENERAL REQUIREMENTS

Precast/prestressed units shall be produced under plant-controlled conditions conforming to PCI Mnl-116 by a firm specializing in providing precast/prestressed concrete floor and roof units and related services.

1.3 DESIGN

Design of units shall be performed by structural analysis in accordance with ACI 318/318R or PCI Mnl-120 whichever is customary with the fabricator. Structural analysis shall include evaluations of the effects of connections, holes, discontinuities, concentrated loads, and joints. Units shall be designed for the load conditions and spans indicated and any additional loads imposed by openings; work of other trades; concrete topping indicated; and all loading and restraining conditions from fabrication, handling, and erection. The sum of the immediate deflection due to live load and additional long-term deflection shall not exceed the deflection limitations indicated. The design shall compensate for the weight of the additional topping required by the camber in order to achieve the minimum topping thickness used in the design.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-01 Data

Floor and Roof Units; GA.

Complete design analysis and load charts signed by a professional engineer and in booklet form for the units to be furnished. Analysis shall include mixture proportion; concrete strength; stress calculations; complete camber calculation showing initial camber, estimated long term camber, and anticipated long term camber and deflection. Design analysis shall indicate which code the design was based on.

SD-04 Drawings

Floor and Roof Units; GA.

Detail drawings shall consist of erection instructions and the following as applicable:

a. Anchorage for work of other trades.

b. Anchorage to supporting construction, if required by the design.

c. Headers for openings where additional structural work is required.

d. Joints between units and between units and other construction.

e. Reinforcing including prestressing steel details.

f. Pick-up points for handling units.

g. Minimum concrete compressive strengths at initial prestress and 28 days, initial prestress to be applied, and minimum release strength.

h. Shoring, unless structural computations are submitted showing that allowable concrete stresses during the work will not be exceeded when shoring is not used.

i. Layout plan and member identification marks.

SD-09 Reports

Tests; FIO.

Certified copies of test reports including all data and results of tests performed as required by PCI Mnl-116 .

1.5 HANDLING AND STORAGE

Units shall be cured prior to delivery to the jobsite. Units shall be stored off the ground and protected from soilage, marring, damage, or overload. Stacked members shall be separated by battens across the full width at bearing points.

PART 2 PRODUCTS

2.1 FABRICATION

Fabrication of the units shall be in accordance with the requirements of PCI Mnl-116. Units shall be made available for inspection by the Contracting Officer at the manufacturer's plant. Shape of units shall be hollow-core slabs as indicated. Unit spans shall be as shown. Units shall be fabricated within the dimensional tolerances given in PCI Mnl-116. Inserts, anchor bolts, bearing plates, and other embedded items shall be located as required or indicated. Where required, units shall be marked to facilitate sequential erection. Openings for

mechanical and utility systems and for architectural purpose shall be as shown. Prestressing eccentricity and force applied shall be adjusted to the extent possible so that the camber provided is the minimum amount needed to produce an approximate level slab after dead loads are applied. Surfaces that will be concealed from view shall be free of surface holes over 13 mm in diameter. Surfaces to receive subsequent applications other than painting shall be suitable for the purpose intended and free of any coatings that would interfere with adhesion or bond. Surfaces that will be painted or exposed to view shall be smooth, free of form marks, and shall have surface blemishes filled and finished to match adjoining concrete in color and texture. Top surfaces which are to receive concrete topping shall be roughened to a full amplitude of approximately 6 mm.

2.2 TESTS

Tests, as required by PCI Mnl-116, shall be performed by an independent testing laboratory or in the manufacturer's approved laboratory if the manufacturer has a PCI certified plant with proof of current certification.

PART 3 EXECUTION

3.1 ERECTION

Erection shall be in accordance with the approved detail drawings. Field welding shall be in accordance with AWS D1.1. Installation of equipment required by other trades shall be accomplished as the work progresses if required by design. Field-cut openings for utilities penetrations shall not be permitted unless recommended by the manufacturer and approved by the Contracting Officer. Bearing surfaces shall be level and free from irregularities. Irregularities in masonry bearing surfaces shall be leveled as recommended by the manufacturer or with a stiff cement grout. Grout shall be allowed to harden before installing the units. Units shall be installed at right angles to bearings, drawn up tight without forcing or distortion, and with sides plumb. Slab ends shall be aligned. Underside of slabs shall present true ceiling surface when the ceiling is exposed to view. Where shown on approved detail drawings, the keyways between units and other spaces shall be cleaned and filled solid with grout. Grout that may have seeped through to surfaces in spaces below shall be removed before hardening. Joints in ceilings that will be exposed to view or painted shall be caulked as specified in Section 07920 JOINT SEALING. Erected units shall be temporarily covered until finish roofing is applied.

3.2 CONCRETE TOPPING

Concrete topping reinforced with welded wire fabric shall be applied to tops of units continuous over the entire span. Welded wire fabric of the size indicated shall be as specified in Section 03200 CONCRETE REINFORCEMENT. Tops of units shall be clean and free of any material that would reduce adhesion or bond. The concrete topping shall be a minimum of 63 mm thick of 28 MPa minimum compressive strength at 28 days. Concrete materials, quality, placing, curing, and finishing shall be as specified in Section 03300 CONCRETE FOR BUILDING CONSTRUCTION.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION PRECAST CONCRETE FLOOR				CONTRACTOR									SPEC. SECTION 03550	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.4 SUBMITTALS										
			SD-01 Data										
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		2	Floor and Roof Units; GA.										
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***** SAFETY PAYS *****

SECTION 04200

MASONRY
04200-07/92

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SECTION 04200

MASONRY
07/92

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI SP-66	(1994) ACI Detailing Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82	(1994) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 153	(1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 615	(1995) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 55	(1995) Concrete Building Brick
ASTM C 67	(1994) Sampling and Testing Brick and Structural Clay Tile
ASTM C 90	(1995) Loadbearing Concrete Masonry Units
ASTM C 126	(1994) Ceramic Glazed Structural Clay Facing Tile, facing Brick and solid masonry units.
ASTM C 140	(1995a) Sampling and Testing Concrete Masonry Units
ASTM C 216	(1995) Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 270	(1995) Mortar for Unit Masonry
ASTM C 476	(1991) Grout for Masonry
ASTM C 494	(1992) Chemical Admixtures for Concrete
ASTM C 578	(1992) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 641	(1982; R 1991) Staining Materials in Lightweight Concrete Aggregates

ASTM C 652	(1994) Hollow Brick (Hollow Masonry Units Made From Clay or Shale)
ASTM C 744	(1995) Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C 780	(1991) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 1019	(1989a; R 1993) Sampling and Testing Grout
ASTM D 2000	(1990, R 1994) Rubber Products in Automotive Applications
ASTM D 2240	(1991) Rubber Property - Durometer Hardness
ASTM D 2287	(1992) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM E 119	(1995a) Fire Tests of Building Construction and Materials
ASTM E 447	(1992b) Compressive Strength of Masonry Prims

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 Submittal Procedures:

SD-01 Data

Clay or Shale Brick; GA.

Concrete Brick; GA.

Insulation; GA.

Manufacturer's descriptive data.

SD-04 Drawings

Masonry Work; GA.

Drawings showing the location and layout of glass block units. Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; and wall openings. Bar splice locations shall be shown. If the contractor chooses to use inch-pound CMU products, then the drawings shall also locate all cut CMU products. Architectural elevations shall be submitted indicating the location of all cut, exposed brick and CMU products. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1 to 50. Reinforcement bending details shall conform to the requirements of ACI SP-66.

Scaffolding Plan; GA.

SD-08 Statements

Cold Weather Installation; GA.

Cold weather construction procedures.

SD-09 Reports

Efflorescence Test; GA.

Field Testing of Mortar; GA.

Field Testing of Grout; GA.

Masonry Cement; GA.

Fire-rated CMU; GA.

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

Special Inspection; GA.

Copies of masonry inspector reports.

SD-13 Certificates

Clay or Shale Brick; FIO.

Concrete Brick; FIO.

Concrete Masonry Units (CMU); FIO.

Prefaced Concrete Masonry Units (GMU); FIO.

Control Joint Keys; FIO.

Anchors, Ties, and Bar Positioners; FIO.

Expansion-Joint Materials; FIO.

Joint Reinforcement; FIO.

Reinforcing Steel Bars and Rods; FIO.

Masonry Cement; FIO.

Mortar Coloring; FIO.

Insulation; FIO.

Precast Concrete Items; FIO.

Mortar Admixtures; FIO.

Grout Admixtures; FIO.

Certificates of compliance stating that the materials meet the specified requirements.

Insulation; GA.

Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

SD-14 Samples

Concrete Masonry Units (CMU); GA.

Prefaced Concrete Masonry Units (GMU); GA.

Concrete Brick; GA.

Clay or Shale Brick; GA.

Color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture.

Anchors, Ties, and Bar Positioners; GA.

Two of each type used.

Expansion-Joint Material; GA.

One piece of each type used.

Joint Reinforcement; GA.

One piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

Insulation; GA.

One piece of board type insulation, not less than 400 mm by 600 mm in size, containing the label indicating the rated permeance and R-values.

Portable Panel; GA.

One panel of clay or shale brick, 600 mm by 600 mm, containing approximately 24 brick facings to establish range of color and texture.

1.3 SAMPLE MASONRY PANELS

After material samples are approved and prior to starting masonry work, two sample masonry panels shall be constructed; one for exterior wall construction and one for interior GMU wall of the Dining Facility. At least 48 hours prior to constructing the sample panel or panels, the Contractor shall submit written notification to the Contracting Officer's Representative. Sample panels shall not be built in, or as part of the structure, but shall be

located where directed.

1.3.1 Configuration

Panels shall be L-shaped or otherwise configured to represent all of the wall elements. Panels shall be of the size necessary to demonstrate the acceptable level of workmanship for each type of masonry represented on the project. The minimum size of a straight panel or a leg of an L-shaped panel shall be 2.5 m by 1.2 m.

1.3.2 Composition

Panels shall show full color range, texture, and bond pattern of the masonry work. The Contractor's method for mortar joint tooling; grouting of reinforced vertical cores, collar joints, pilasters, bond beams, and lintels; positioning, securing, and lapping of reinforcing steel; positioning and lapping of joint reinforcement (including prefabricated corners); and cleaning of masonry work shall be demonstrated during the construction of the panels. Installation or application procedures for anchors, wall ties, CMU control joints, brick expansion joints, insulation, flashing, brick soldier, row lock courses and weepholes shall be shown in the sample panels. The panels shall contain a masonry bonded corner that includes a bond beam corner. Panels that represent reinforced masonry shall contain a 600 mm by 600 mm opening placed at least 600 mm above the panel base and 600 mm away from all free edges, corners, and control joints. Required reinforcing shall be provided around this opening as well as at wall corners and control joints.

1.3.3 Construction Method

Where anchored veneer walls are required, the Contractor shall demonstrate and receive approval for the method of construction; i.e., either bring up the two wythes together or separately, with the insulation and appropriate ties placed within the specified tolerances across the cavity. Temporary provisions shall be demonstrated to preclude mortar or grout droppings in the cavity and to provide a clear open air space of the dimensions shown on the drawings. Where masonry is to be grouted, the Contractor shall demonstrate and receive approval on the method that will be used to bring up the masonry wythes; support the reinforcing bars; and grout cells, bond beams, lintels, and collar joints using the requirements specified herein. If sealer is specified to be applied to the masonry units, sealer shall be applied to the sample panels. Panels shall be built on a properly designed concrete foundation.

1.3.3.1 GMU Construction Criteria

Glazed Masonry Units (GMU) shall be constructed only by an experienced GMU mason with documented exprience and photographs of at least three 3 previous acceptable projects using GMU.

1.3.4 Usage

The completed panels shall be used as the standard of workmanship for the type of masonry represented. Masonry work shall not commence until the sample panel for that type of masonry construction has been completed and approved. Panels shall be protected from the weather and construction operations until the masonry work has been completed and approved. After completion of the work, the sample panels, including all foundation concrete, shall become the property of the Contractor and shall be removed from the construction site.

1.4 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

1.4.1 Masonry Units

Concrete masonry units shall be covered or protected from inclement weather and shall conform to the moisture

content as specified in ASTM C 90 when delivered to the jobsite. Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.4.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.4.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

1.5 SPECIAL INSPECTION

A qualified masonry inspector approved by the Contracting Officer shall perform inspection of the masonry work. Minimum qualifications for the masonry inspector shall be 5 years of reinforced masonry inspection experience, which includes GMU experience or acceptance by a State, municipality, or other governmental body having a program of examining and certifying inspectors for reinforced masonry construction. The masonry inspector shall be present during preparation of masonry prisms, sampling and placing of masonry units, placement of reinforcement (including placement of dowels in footings and foundation walls), inspection of grout space, immediately prior to closing of cleanouts, and during grouting operations. The masonry inspector shall assure Contractor compliance with the drawings and specifications. The masonry inspector shall keep a complete record of all inspections and shall submit daily written reports to the Quality Control Supervisory Representative reporting the quality of masonry construction.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval. The contractor has the option to use either hard metric or substitute English inch-pound (soft metric) CMU products. If the general contractor decides to substitute English inch-pound CMU products, then the following additional requirements shall be met:

2.1.1 The metric dimensions indicated on the drawings shall not be altered to accommodate English inch-pound CMU products either horizontally or vertically. The 100mm building module will be maintained, except for the CMU products themsellves.

2.1.2 Motar joint widths shall be maintained as specified.

2.1.3 Indicated reinforcing bar spacing shall not be exceeded. Inch-pound CMU products must accommodate reinforcing bar placement. Rebars will not be cut, bent or eliminated to fit into the inch-pound CMU products module.

2.1.4 Brick and inch-pound CMU products cannot be reduced in size by more than one-third (1/3) in height and one-half (1/2) in length. Cut CMU products shall not be located at ends of walls, corners and other openings.

2.1.5 Cut, exposed brick and CMU products shall be held to a minimum and shall be located where it would have the least impact on the architectural aesthetic goals of the facility.

2.1.6 Other building components, built into the CMU products, such as window frames, door frames, louvers, grilles, fire dampers, etc, that are required to be metric, will remain metric.

2.1.7 Additional metric guidance can be found in Section 01030 METRIC MEASUREMENTS.

2.2 CLAY OR SHALE BRICK

Color range and texture of clay or shale brick shall be as indicated and shall conform to the approved sample. Grade SW shall be used for brick in contact with earth or grade and for the first six exterior courses above grade. Grade SW or MW shall be used in other brickwork. Brick shall be tested for efflorescence. Clay or shale brick units shall be delivered factory-blended to provide a uniform appearance and color range in the completed wall.

2.2.1 Solid Clay or Shale Brick

Solid clay or shale shall conform to ASTM C 216, Type FBS. Brick size shall be modular and the nominal size of the brick used shall be 90 mm thick, 57 mm wide, and 190 mm long. Minimum compressive strength of the brick shall be 17.5 MPa.

2.2.2 Hollow Clay or Shale Brick

Hollow clay or shale brick shall conform to ASTM C 652, Type HBX. Brick size shall be modular and the nominal size of the brick used shall be 101 mm thick, 68 mm wide, and 203 mm long. Where vertical reinforcement is shown in hollow brick, the minimum cell dimension shall be 64 mm and the units shall be designed to provide precise vertical alignment of the cells. Minimum compressive strength of the brick shall be 17.5 MPa.

2.3 CONCRETE BRICK

Concrete brick shall conform to ASTM C 55, Type I, Grade N-I. Concrete brick may be used where necessary for filling out in concrete masonry unit construction.

2.4 CONCRETE MASONRY UNITS (CMU)

Hollow and solid concrete masonry units shall conform to ASTM C 90, Type I, Normal weight. Cement shall have a low alkali content and be of one brand.

2.4.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

2.4.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be 25 mm. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

2.4.2.1 Architectural Units

Units shall have patterned face shell. Face shell pattern shall be split faced. Units shall be integrally colored during manufacture. Color shall be as indicated on the drawings. Patterned face shell shall be properly aligned in the completed wall. All split faced units shall be fabricated with integral water repellent. Units shall be tested for efflorescence. Sampling and testing shall conform to the provisions of ASTM C 67. Units shall receive a rating of "not effloresced". Testing shall be conducted be an independent testing lab and test reports shall be submitted for government approval prior to delivery of units to the project site.

2.4.3 Fire-Rated CMU

Concrete masonry units used in fire-rated construction shown on the drawings shall be of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated on the aggregate requiring the greater minimum equivalent thickness to produce the required fire rating.

TABLE I

FIRE-RATED CONCRETE MASONRY UNITS
See note (a) below

Aggregate Type	Minimum equivalent thickness in mm for fire rating of: 4 hours	3 hours	2 hours
Pumice	120	100	75
Expanded slag	130	110	85
Expanded clay, shale, or slate	145	120	95
Limestone, scoria, cinders or unexpanded slag	150	130	100
Calcareous gravel	160	135	105
Siliceous gravel	170	145	115

(a) Minimum equivalent thickness shall equal net volume as determined in conformance with ASTM C 140 divided by the product of the actual length and height of the face shell of the unit in millimeters. Where walls are to receive plaster or be faced with brick, or otherwise form an assembly; the thickness of plaster or brick or other material in the assembly will be included in determining the equivalent thickness.

2.5 PREFACED CONCRETE MASONRY UNITS (GMU)

Prefaced concrete masonry units shall conform to ASTM C 744 using masonry units conforming to ASTM C 90, Type 1, 200mm wide x 400mm long scored to 200mm x 200mm and pattern inset units scored vertically in four 200 x 100 mm sections. The facing shall turn over the edges and ends of the unit at least 10 mm in the direction of the thickness of the unit to form a lip at least 2 mm thick. Variation in color and texture shall not exceed that of the approved samples. All shapes and sizes shall be provided for a complete installation. Bullnose units shall be used along sills and caps and at vertical external corners including door jambs, window jambs, and other such openings. Radius of the bullnose shall be 25 mm. Base units shall be coved to meet finished floor surfaces where ceramic tile floor occurs.

2.6 PRECAST CONCRETE ITEMS

Splashblocks shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be 28 MPa minimum conforming to Section 03300 CONCRETE FOR BUILDING CONSTRUCTION using 13 mm to No. 4 nominal-size coarse aggregate, and minimum reinforcement shall be the reinforcement required for handling of the units. Clearance of 20 mm shall be maintained between reinforcement and faces of units. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 827 kPa for at least 5 hours, the items, after casting, shall be either damp-cured for 24 hours or steam-cured and shall then be aged under cover for 28 days or longer. Exposed-to-view surfaces shall be free of surface voids, spalls, cracks, and chipped or broken edges. Precast units exposed-to-view shall be of uniform appearance and color. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

2.6.1 Splash Blocks

Splash blocks shall be reinforced concrete of the manufacturer's standard design.

2.7 MORTAR

Mortar shall be Type S in accordance with the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate. Prepackaged masonry cement shall not be allowed. Mortar for prefaced concrete masonry unit wainscots shall contain aggregates with 100 percent passing the 2.36 mm sieve and 95 percent passing the 1.18 mm sieve. Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source. Efflorescence testing of mortar shall be in accordance with ASTM C 67. Any component causing efflorescence shall be rejected.

2.7.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2% chlorides, and shall conform to ASTM C 494, Type F.

Provide water repellent admixture for mortar to be used with split faced block which has factory applied water repellent.

2.7.2 Coloring

Mortar coloring shall be added to the mortar used for exposed masonry surfaces to produce a uniform color which shall be as indicated on the drawings. Mortar coloring shall not exceed 3 percent of the weight of cement for carbon black and ten percent of the weight of cement for all other pigments. Mortar coloring shall be chemically inert, of finely ground limeproof pigment, and furnished in accurately pre-measured and packaged units that can be added to a measured amount of cement.

2.7.3 Mortar Screen

Provide 25 mm thick high density polyethylene mortar screen at base of wall between the insulation and cast stone to suspend mortar droppings in a manner to allow cavity moisture to drain through the weep holes.

2.8 GROUT

Grout shall contain plasticizer admixture and conform to ASTM C 476. Cement used in grout shall have a low

alkali content. Grout slump shall be between 200 and 250 mm. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements. Efflorescence testing of grout shall be in accordance with ASTM C 67. Any componet causing efflorescence shall be rejected.

2.8.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and conform to ASTM C 494, Type F.

2.8.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.8.3 Prefaced Concrete masonry Units (GMU)

Epoxy grout (Dining Facility #7048 only). All natural and scored joints shall be grouted for tuck pointing using an approved , water resistant, epoxy grout, suah as Latapoxy SP 100 (by Laticrete)or approved equal on prefaced concrete masonry units. (GMU)

2.9 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A 82. Anchors and ties shall be sized to provide a minimum of 16 mm mortar cover from either face.

2.9.1 Wire Mesh Ties

Wire mesh for tying 100 mm thick concrete masonry unit partitions to other intersecting masonry partitions shall be 13 mm mesh of minimum 16 gauge steel wire. Minimum lengths shall be not less than 300 mm.

2.9.2 Wall Ties

Wall ties shall be rectangular-shaped or Z-shaped fabricated of 5 mm diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 100 mm wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 5 mm diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 13 mm eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 2 mm. The pintle and eye elements shall be formed so that both can be in the same plane.

2.9.3 Dovetail Anchors

Dovetail anchors shall be of the flexible wire type, 5 mm diameter zinc-coated steel wire, triangular shaped, and attached to a 12 gauge or heavier steel dovetail section or welded to a steel column. These anchors shall be used for anchorage of veneer wythes or composite-wall facings extending over the face of concrete columns, beams, or walls. Cells within vertical planes of these anchors shall be filled solid with grout for full height of walls or partitions, or solid units may be used. Dovetail slots are specified in Section 03300 CONCRETE FOR BUILDING CONSTRUCTION.

2.9.4 Adjustable Anchors

Adjustable anchors shall be 5 mm diameter steel wire, triangular-shaped. Anchors attached to steel shall be 8 mm diameter steel bars placed to provide 2 mm play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

2.9.5 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.10 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153, class B-2. All wires shall be a minimum of 5 mm thickness. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 16 mm cover from either face. The distance between crosswires shall not exceed 400 mm. Joint reinforcement for straight runs shall be furnished in flat sections not less than 3 m long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features.

2.11 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615M, Grade 60.

2.12 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000 or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 16 mm thick and 10 mm thick flanges, with a tolerance of plus or minus 2 mm. The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 34 degrees C after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

2.13 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07920 CAULKING AND SEALANTS.

2.14 INSULATION

2.14.1 Rigid Board-Type Insulation

Rigid board-type insulation shall be Type IV extruded polystyrene. Polystyrene shall conform to ASTM C 578. The insulation shall be a standard product and shall be marked with not less than the manufacturer's trademark or name, the specification number, the permeance and R-values.

2.14.1.1 Insulation Thickness and Air Space

The cavity space shall allow for a maximum insulation thickness of 50 mm, and a minimum air space of 20 mm.

2.14.1.2 Aged R-Value

The insulation shall provide a minimum aged R-value of 8 for the overall thickness. The aged R-value shall be determined at 24 degrees C in accordance with the appropriate referenced specification. The stated R-value of the insulation shall be certified by an independent testing laboratory or certified by an independent Registered Professional Engineer if tests are conducted in the manufacturer's laboratory.

2.14.1.3 Recovered Material

Insulation shall contain the highest practicable percentage of recovered material derived from solid waste (but material reused in the manufacturing process cannot be counted toward the percentage of recovered material). Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided.

2.14.2 Insulation Adhesive

Insulation adhesive shall be specifically prepared to adhere the insulation to the masonry and, where applicable, to the thru-wall flashing. The adhesive shall not deleteriously affect the insulation, and shall have a record of satisfactory and proven performance for the conditions under which to be used.

2.15 FLASHING

Flashing shall be as specified in Sections 07600 SHEET METALWORK, GENERAL.

2.16 WEEP HOLE VENTILATORS

Weephole ventilators shall be prefabricated polyprolylene cell type vents designed to prevent insect entry with maximum air entry. Ventilators shall be sized to match modular construction with a standard 10 mm mortar joint.

PART 3 EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 37 degrees C in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 1.2 m ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 4 degrees C, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

3.1.2.1 Preparation

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully

until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

a. Air Temperature 4 to 0 degrees C. Sand or mixing water shall be heated to produce mortar temperatures between 4 degrees C and 49 degrees C.

b. Air Temperature 0 to minus 4 degrees C. Sand and mixing water shall be heated to produce mortar temperatures between 4 degrees C and 49 degrees C. Temperature of mortar on boards shall be maintained above freezing.

c. Air Temperature minus 4 to minus 7 degrees C. Sand and mixing water shall be heated to provide mortar temperatures between 4 degrees C and 49 degrees C. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 24 km/hour.

d. Air Temperature minus 7 degrees C and below. Sand and mixing water shall be heated to provide mortar temperatures between 4 degrees C and 49 degrees C. Enclosure and auxiliary heat shall be provided to maintain air temperature above 0 degrees C. Temperature of units when laid shall not be less than minus 7 degrees C.

3.1.2.2 Completed Masonry and Masonry Not Being Worked On

a. Mean daily air temperature 4 degrees C to 0 degrees C. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.

b. Mean daily air temperature 0 degrees C to minus 4 degrees C. Masonry shall be completely covered with weather-resistant membrane for 24 hours.

c. Mean Daily Air Temperature minus 4 degrees C to minus 7 degrees C. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.

d. Mean Daily Temperature minus 7 degrees C and Below. Masonry temperature shall be maintained above 0 degrees C for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running bond pattern, except units exposed to view shall be laid in stacked bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 13 mm. Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be free from chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 13 mm into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below. In double wythe construction, the inner wythe may be brought up not more than 400 mm ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 200 mm.

3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 3 mm. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

3.2.2 Forms and Shores

Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

3.2.4 Clay or Shale Brick Units

Brick facing shall be laid with the better face exposed. Brick shall be laid in running bond with each course bonded at corners, unless otherwise indicated. Molded brick shall be laid with the frog side down. Brick that is cored, recessed, or has other deformations may be used in sills, treads, soldier courses, except where deformations will be exposed to view.

3.2.4.1 Wetting of Units

Wetting of clay, shale brick, or hollow brick units having an initial rate of absorption of more than 0.155 gm per minute per square cm of bed surface shall be in conformance with ASTM C 67. The method of wetting shall ensure that each unit is nearly saturated but surface dry when laid.

3.2.4.2 Solid Units

Bed, head, and collar joints shall be completely filled with mortar.

3.2.4.3 Hollow Units

Hollow units shall be laid as specified for concrete masonry units.

3.2.5 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

TABLE II
TOLERANCES

Variation from the plumb in the lines

and surfaces of columns, walls and arises

In adjacent masonry units	3 mm
In 3 m	6 mm
In 6 m	10 mm
In 12 m or more	13 mm

Variations from the plumb for external corners, expansion joints, and other conspicuous lines

In 6 m	6 mm
In 12 m or more	13 mm

Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines

In 6 m	6 mm
In 12 m or more	13 mm

Variation from level for bed joints and top surfaces of bearing walls

In 3 m	6 mm
In 12 m or more	13 mm

Variations from horizontal lines

In 3 m	6 mm
In 6 m	10 mm
In 12 m or more	13 mm

Variations in cross sectional dimensions of columns and in thickness of walls

Minus	6 mm
Plus	13 mm

3.2.6 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 300 mm wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.7 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.7.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight.

3.2.7.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.7.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm.

3.2.7.4 Seamless Wall Coatings

Joints in areas to receive seamless wall coatings shall receive flush joints.

3.2.8 Joint Widths

Joint widths shall be as follows:

3.2.8.1 Concrete Masonry Units

Concrete masonry units shall have 10 mm joints, except for prefaced concrete masonry units.

3.2.8.3 Brick

Brick joint widths shall be the difference between the actual and nominal dimensions of the brick in either height or length. Brick expansion joint widths shall be as shown.

3.2.9 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Anchors, ties and joint reinforcement shall be fully embedded in the mortar. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

3.2.10 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Toothing may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

3.2.11 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied

together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

3.2.12 Partitions

Partitions shall be continuous from floor to underside of floor or roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 100 mm above the ceiling level. An isolation joint shall be placed in the intersection between partitions and structural or exterior walls as shown. Interior partitions having 100 mm nominal thick units shall be tied to intersecting partitions of 100 mm units, 125 mm into partitions of 150 mm units, and 175 into partitions of 200 mm or thicker units. Cells within vertical plane of ties shall be filled solid with grout for full height of partition or solid masonry units may be used. Interior partitions having masonry walls over 100 mm thick shall be tied together with joint reinforcement. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

3.3 ANCHORED VENEER CONSTRUCTION

The inner and outer wythes shall be completely separated by a continuous airspace as shown on the drawings. Both the inner and the outer wythes shall be laid up together except when adjustable joint reinforcement assemblies are approved for use. When both wythes are not brought up together, through-wall flashings shall be protected from damage until they are fully enclosed in the wall. The airspace between the wythes shall be kept clear and free of mortar droppings by temporary wood strips laid on the wall ties and carefully lifted out before placing the next row of ties. A coarse gravel or drainage material shall be placed behind the weep holes in the cavity to a minimum depth of 100 mm of coarse aggregate or 250 mm of drainage material to keep mortar droppings from plugging the weep holes.

3.4 WEEP HOLES

Weep holes shall be provided not more than 800 mm on centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be constructed using weep hole ventilators. Weep holes shall be kept free of mortar and other obstructions.

3.5 COMPOSITE WALLS

Masonry wythes shall be tied together with joint reinforcement or with unit wall ties. Facing shall be anchored to concrete backing with wire dovetail anchors set in slots built in the face of the concrete as specified in Section 03300 CONCRETE FOR BUILDING CONSTRUCTION. The facing wythe shall be anchored or tied to the backup at a maximum spacing of 400 mm on center vertically and 600 mm on center horizontally. Unit ties shall be spaced not over 600 mm on centers horizontally, in courses not over 400 mm apart vertically, staggered in alternate courses. Ties shall be laid not closer than 16 mm to either masonry face. Ties shall not extend through control joints. Collar joints between masonry facing and masonry backup shall be filled solidly with grout.

3.6 PREFACED CONCRETE MASONRY UNITS (GMU) (Dining Facility # 7048)

Prefaced concrete masonry units shall be installed as specified for concrete masonry units and as required herein. The facing shall be used for dimensional and plane reference in the installation. Prefaced concrete masonry units shall be layed with a 6mm joint size at the surface and 10 mm joint size in the concrete block backing. Wainscots shall be of full courses to approximate as nearly as possible the height indicated, except that in no case shall the wainscots be lower than 50 mm below the specified height. Units shall be set level and true so that bases and walls will present true planes and surfaces free of waviness, offset, or other distortion. Joint reinforcing shall be placed not over 400 mm on center vertically.

3.7 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

3.8 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 50 mm of tops of walls.

3.8.1 Positioning Bars

Vertical bars shall be accurately placed within the center of the cell unless otherwise indicated on the drawings. A minimum clearance of 13 mm shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing shall be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.8.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.9 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 400 mm on center or as indicated. Reinforcement shall be lapped not less than 150 mm. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 16 mm cover to either face of the unit.

3.10 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

3.10.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 10 m apart, or as required, to limit the horizontal flow of grout for each pour.

3.10.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

3.10.3 Grout Holes and Cleanouts

3.10.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 400 mm on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings shall not be less than 100 mm in diameter or 75 by 100 mm in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

3.10.3.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 1.5 m. Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 800 mm where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 75 by 100 mm openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.10.3.3 Cleanouts for Solid Unit Masonry Construction

Cleanouts for construction of walls consisting of a grout filled cavity between solid masonry wythes shall be provided at the bottom of every pour by omitting every other masonry unit from one wythe. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanout holes shall not be plugged until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.10.4 Grouting Equipment

3.10.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed of outside the masonry.

3.10.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

3.10.5 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without

segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 1.5 m in height. High-lift grout methods shall be used on pours exceeding 1.5 m in height.

3.10.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 13 mm into the grout space shall be removed before beginning the grouting operation. Grout pours 300 mm or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 300 mm in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

3.10.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 6 mm into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 1.2 m in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 300 to 450 mm into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (m) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (mm) (1,2) Multiwythe Masonry (3)	Hollow-unit Masonry
0.3	Fine	Low Lift	20	40 x 50
1.5	Fine	Low Lift	50	50 x 75
2.4	Fine	High Lift	50	50 x 75
3.6	Fine	High Lift	65	65 x 75
7.3	Fine	High Lift	75	75 x 75
0.3	Coarse	Low Lift	40	40 x 75
1.5	Coarse	Low Lift	50	65 x 75
2.4	Coarse	High Lift	50	75 x 75

3.6	Coarse	High Lift	65	75 x 75
7.3	Coarse	High Lift	75	75 x 100

Notes:

(1) The actual grout space or cell dimension must be larger than the sum of the following items:
a) The required minimum dimensions of total clear areas given in the table above;
b) The width of any mortar projections within the space;
c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.

(2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 20 mm or greater in width.

(3) For grouting spaces between masonry wythes.

(4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.11 PLACING PREFACED CONCRETE MASONRY UNIT (GMU) GROUT (Dining Facility Only #7048)

Natural joints shall be raked as the job progresses and all joints, natural and scored, are to be grouted or tuck pointed together. Due to the high bonding strength of epoxy grout, the walls shall be kept very clean during the laying process by bagging (wiping the wall with a burlap bag to remove excess grout) or brushing. (Note: any cleaner strong enough to clean hardened epoxy grout may destroy the glazed masonry unit facing.)

3.12 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 20 mm shall be maintained between reinforcement and interior faces of units.

3.13 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using special control-joint units or sash jamb units with control joint key in accordance with the details shown on the drawings. Sash jamb units shall have a 19 by 19 mm groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 20 mm; backer rod and sealant shall be installed in accordance with Section 07920 CAULKING AND SEALANTS. Exposed interior control joints shall be raked to a depth of 6 mm. Concealed control joints shall be flush cut.

3.14 BRICK EXPANSION JOINTS AND CONCRETE MASONRY VENEER JOINTS

Brick expansion joints and concrete masonry veneer joints shall be provided and constructed as shown on the drawings. Joints shall be kept free of mortar and other debris.

3.15 SHELF ANGLES

Shelf angles shall be adjusted as required to keep the masonry level and at the proper elevation. Shelf angles shall

be galvanized. Shelf angles shall be provided in sections not longer than 3 m and installed with a 6 mm gap between sections. Shelf angles shall be mitered and welded at building corners with each angle not shorter than 1.2 m, unless limited by wall configuration.

3.16 LINTELS

3.16.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 15 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 600 mm, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 15 mm above the bottom inside surface of the lintel unit.

3.16.2 Precast Concrete and Steel Lintels

Precast concrete and steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel and precast lintels shall have a minimum bearing length of 200 mm unless otherwise indicated on the drawings.

3.17 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

3.18 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.18.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 400 mm on centers vertically and 600 mm on center horizontally.

3.18.2 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 400 mm on centers vertically, and if applicable, not over 600 mm on centers horizontally.

3.19 INSULATION

Anchored veneer walls shall be insulated, where shown, by installing board-type insulation on the cavity side of the inner wythe. Board type insulation shall be applied directly to the masonry or thru-wall flashing with adhesive. Insulation shall be neatly fitted between obstructions without impaling of insulation on ties or anchors. The insulation shall be applied in parallel courses with vertical joints breaking midway over the course below and shall be applied in moderate contact with adjoining units without forcing, and shall be cut to fit neatly against adjoining surfaces.

3.20 SPLASH BLOCKS

Splash blocks shall be located as shown.

3.21 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and

tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning. The contractor shall at his own expense remove singular masonry units due to extensive efflorescence discoloration or unit breakage at the direction of the Contracting Officer representative.

3.21.1 Concrete Masonry Unit and Concrete Brick Surfaces

Exposed concrete masonry unit and concrete brick surfaces shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.21.2 Clay, Shale Brick Surfaces and Architectural Units

Exposed clay, shale brick and architectural masonry units masonry surfaces shall be cleaned as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. After cleaning, the sample panel of similar material shall be examined for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, the method of cleaning shall be changed to assure that the masonry surfaces in the structure will not be adversely affected. The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned 30 milliliters trisodium phosphate and 30 milliliters laundry detergent to 1 liter of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay products manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

3.22 BEARING PLATES

Bearing plates for beams, joists, joist girders and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Bedding mortar and non-shrink grout shall be as specified in Section 03300 CONCRETE FOR BUILDING CONSTRUCTION.

3.23 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 600 mm down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.24 TEST REPORTS

3.24.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 13 to 16 mm thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780. Efflorescence testing shall be in accordance with ASTM C 67.

3.24.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. Efflorescence testing shall be in accordance with ASTM C 67. A minimum of three specimens of grout per day

shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 20 MPa at 28 days.

3.24.3 Efflorescence Test

Brick, split faced and scored CMU which will be exposed to weathering shall be tested for efflorescence. Tests shall be scheduled far enough in advance of starting masonry work to permit retesting if necessary. Sampling and testing shall conform to the applicable provisions of ASTM C 67. Units meeting the definition of "effloresced" will be subjected to rejection.

3.26.4 Prism Tests

At least one prism test sample shall be made for each 465 square meters of wall but not less than three such samples shall be made for any building. Three prisms shall be used in each sample. Prisms shall be tested in accordance with ASTM E 447. Seven-day tests may be used provided the relationship between the 7- and 28-day strengths of the masonry is established by the tests of the materials used. Compressive strength shall not be less than 9.3 MPa at 28 days. If the compressive strength of any prism falls below the specified value by more than 3.5 MPa, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. If the likelihood of low-strength masonry is confirmed and computations indicate that the load-carrying capacity may have been significantly reduced, tests of cores drilled, or prisms sawed, from the area in question may be required. In such case, three specimens shall be taken for each prism test more than 3.5 MPa below the specified value. Masonry in the area in question shall be considered structurally adequate if the average compressive strength of three specimens is equal to at least 85 percent of the specified value, and if the compressive strength of no single specimen is less than 75 percent of the specified value. Additional testing of specimens extracted from locations represented by erratic core or prism strength test results shall be permitted.

3.25 MORTAR SCREEN

Install continuous mortar screen with dovetail side up at base of wall between the insulation and cast stone to divert moisture out of the cavity and toward the weep holes.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION				CONTRACTOR									SPEC. SECTION 04200	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Clay or Shale Brick; GA.										
		2	Concrete Brick; GA.										
		3	Insulation; GA.										
			SD-04 Drawings										
		4	Masonry Work; GA.										
		5	Scaffolding Plan; GA.										
			SD-08 Statements										
		6	Cold Weather Installation; GA.										
			SD-09 Reports										
		7	Efflorescence Test; GA.										
		8	Field Testing of Mortar; GA.										
		9	Field Testing of Grout; GA.										
		10	Masonry Cement; GA.										
		11	Fire-rated CMU; GA.										
		12	Special Inspection; GA.										
			SD-13 Certificates										
		13	Clay or Shale Brick; FIO.										
		14	Concrete Brick; FIO.										
		15	Concrete Masonry Units (CMU); FIO.										
		16	Prefaced Concrete Masonry Units (GMU); FIO.										
		17	Control Joint Keys; FIO.										
		18	Anchors, Ties, and Bar Positioners; FIO.										
		19	Expansion-Joint Materials; FIO.										
		20	Joint Reinforcement; FIO.										
		21	Reinforcing Steel Bars and Rods; FIO.										
		22	Masonry Cement; FIO.										
		23	Mortar Coloring; FIO.										
		24	Insulation; FIO.										
		25	Precast Concrete Items; FIO.										
		26	Mortar Admixtures; FIO.										
		27	Grout Admixtures; FIO.										
		28	Insulation; GA.										
			SD-14 Samples										
		29	Concrete Masonry Units (CMU); GA.										

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION $$
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
		30	Prefaced Concrete Masonry Units (GMU); GA.										
		31	Concrete Brick; GA.										
		32	Clay or Shale Brick; GA.										
		33	Anchors, Ties, and Bar Positioners; GA.										
		34	Expansion-Joint Material; GA.										
		35	Joint Reinforcement; GA.										
		36	Insulation; GA.										
		37	Portable Panel; GA.										

***** SAFETY PAYS *****

SECTION 05055

WELDING, STRUCTURAL
11/88

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1.6 WELDER, WELDING OPERATOR, AND TACKER QUALIFICATION 05055-2
1.7 INSPECTOR QUALIFICATION 05055-3
1.8 SYMBOLS 05055-4
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--END OF SECTION-- 05055-5

SECTION 05055

WELDING, STRUCTURAL
11/88

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC-04 (1989) Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT-01 (1992; Supple) Recommended Practice SNT-TC-1A

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (1993) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS A3.0 (1994) Standard Welding Terms and Definitions

AWS D1.1 (1996) Structural Welding Code - Steel

AWS Z49.1 (1988) Safety in Welding and Cutting

1.2 DEFINITIONS

Definitions of welding terms shall be in accordance with AWS A3.0.

1.3 GENERAL REQUIREMENTS

The design of welded connections shall conform to AISC-04 unless otherwise indicated or specified. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Welding shall be as specified in this section, except where additional requirements are shown on the drawings or are specified in other sections. Welding shall not be started until welding procedures, welders, welding operators, and tackers have been qualified and the submittals approved by the Contracting Officer. Qualification testing shall be performed at or near the work site. Each Contractor performing welding shall maintain records of the test results obtained in welding procedure, welder, welding operator, and tacker performance qualifications.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-08 Statements

Welding Procedure Qualifications; FIO.

Welder, Welding Operator, and Tacker Qualification; GA.

Inspector Qualification; GA.

Copies of the welding procedure specifications; the procedure qualification test records; and the welder, welding operator, or tacker qualification test records.

SD-18 Records

Quality Control; FIO.

A quality assurance plan and records of tests and inspections.

1.5 WELDING PROCEDURE QUALIFICATIONS

Except for prequalified (per AWS D1.1) and previously qualified procedures, each Contractor performing welding shall record in detail and shall qualify the welding procedure specification for any welding procedure followed in the fabrication of weldments. Qualification of welding procedures shall conform to AWS D1.1 and to the specifications in this section. Copies of the welding procedure specification and the results of the procedure qualification test for each type of welding which requires procedure qualification shall be submitted for approval. Approval of any procedure, however, will not relieve the Contractor of the sole responsibility for producing a finished structure meeting all the requirements of these specifications. This information shall be submitted on the forms in Appendix E of AWS D1.1. Welding procedure specifications shall be individually identified and shall be referenced on the detail drawings and erection drawings, or shall be suitably keyed to the contract drawings. In case of conflict between this specification and AWS D1.1, this specification governs.

1.5.1 Previous Qualifications

Welding procedures previously qualified by test may be accepted for this contract without requalification if the following conditions are met:

a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.5.2 Prequalified Procedures

Welding procedures which are considered prequalified as specified in AWS D1.1 will be accepted without further qualification. The Contractor shall submit for approval a listing or an annotated drawing to indicate the joints not prequalified. Procedure qualification shall be required for these joints.

1.5.3 Retests

If welding procedure fails to meet the requirements of AWS D1.1, the procedure specification shall be revised and requalified, or at the Contractor's option, welding procedure may be retested in accordance with AWS D1.1 . If the welding procedure is qualified through retesting, all test results, including those of test welds that failed to meet the requirements, shall be submitted with the welding procedure.

1.6 WELDER, WELDING OPERATOR, AND TACKER QUALIFICATION

Each welder, welding operator, and tacker assigned to work on this contract shall be qualified in accordance with

the applicable requirements of AWS D1.1 and as specified in this section. Welders, welding operators, and tackers who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used.

1.6.1 Previous Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tackers qualified by test within the previous 6 months may be accepted for this contract without requalification if all the following conditions are met:

a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder, welding operator, and tacker qualification test records are submitted and approved in accordance with the specified requirements for detail drawings.

b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

c. The previously qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

d. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.6.2 Certificates

Before assigning any welder, welding operator, or tacker to work under this contract, the Contractor shall submit the names of the welders, welding operators, and tackers to be employed, and certification that each individual is qualified as specified. The certification shall state the type of welding and positions for which the welder, welding operator, or tacker is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests. The certification shall be kept on file, and 3 copies shall be furnished. The certification shall be kept current for the duration of the contract.

1.6.3 Renewal of Qualification

Requalification of a welder or welding operator shall be required under any of the following conditions:

a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.

b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.

c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract, and a qualification test has not been taken within the past 12 months. Records showing periods of employment, name of employer where welder, or welding operator, was last employed, and the process for which qualified shall be submitted as evidence of conformance.

d. A tacker who passes the qualification test shall be considered eligible to perform tack welding indefinitely in the positions and with the processes for which he is qualified, unless there is some specific reason to question the tacker's ability. In such a case, the tacker shall be required to pass the prescribed tack welding test.

1.7 INSPECTOR QUALIFICATION

Inspection and nondestructive testing personnel shall be qualified in accordance with the requirements of ASNT-01 for Levels I or II in the applicable nondestructive testing method. The inspector may be supported by assistant welding inspectors who are not qualified to ASNT-01, and assistant inspectors may perform specific inspection functions under the supervision of the qualified inspector.

1.8 SYMBOLS

Symbols shall be in accordance with AWS A2.4, unless otherwise indicated.

1.9 SAFETY

Safety precautions during welding shall conform to AWS Z49.1.

PART 2 PRODUCTS

2.1 WELDING EQUIPMENT AND MATERIALS

All welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator performing qualified welding procedures. All welding equipment and materials shall comply with the applicable requirements of AWS D1.1.

PART 3 EXECUTION

3.1 WELDING OPERATIONS

3.1.1 Requirements

Workmanship and techniques for welded construction shall conform to the requirements of AWS D1.1 and AISC-04. When AWS D1.1 and the AISC-04 specification conflict, the requirements of AWS D1.1 shall govern.

3.1.2 Identification

Welds shall be identified in one of the following ways:

a. Written records shall be submitted to indicate the location of welds made by each welder, welding operator, or tacker.

b. Each welder, welding operator, or tacker shall be assigned a number, letter, or symbol to identify welds made by that individual. The Contracting Officer may require welders, welding operators, and tackers to apply their symbol next to the weld by means of rubber stamp, felt-tipped marker with waterproof ink, or other methods that do not cause an indentation in the metal. For seam welds, the identification mark shall be adjacent to the weld at 1 meter intervals. Identification with die stamps or electric etchers shall not be allowed.

3.2 QUALITY CONTROL

Testing shall be done by an approved inspection or testing laboratory or technical consultant, or if approved, the Contractor's inspection and testing personnel may be used instead of the commercial inspection or testing laboratory or technical consultant. The Contractor shall perform visual and ultrasonic inspection to determine conformance with paragraph STANDARDS OF ACCEPTANCE. Procedures and techniques for inspection shall be in accordance with applicable requirements of AWS D1.1.

3.3 STANDARDS OF ACCEPTANCE

Dimensional tolerances for welded construction, details of welds, and quality of welds shall be in accordance with the applicable requirements of AWS D1.1 and the contract drawings. Nondestructive testing shall be by visual inspection and ultrasonic methods. The minimum extent of nondestructive testing shall be random 25 percent of welds or joints.

3.3.1 Nondestructive Examination

The welding shall be subject to inspection and tests in the mill, shop, and field. Inspection and tests in the mill or

shop will not relieve the Contractor of the responsibility to furnish weldments of satisfactory quality. When materials or workmanship do not conform to the specification requirements, the Government reserves the right to reject material or workmanship or both at any time before final acceptance of the structure containing the weldment.

3.4 GOVERNMENT INSPECTION AND TESTING

In addition to the inspection and tests performed by the Contractor for quality control, the Government will perform inspection and testing for acceptance to the extent determined by the Contracting Officer. The costs of such inspection and testing will be borne by the Contractor if unsatisfactory welds are discovered, or by the Government if the welds are satisfactory. The work may be performed by the Government's own forces or under a separate contract for inspection and testing. The Government reserves the right to perform supplemental nondestructive and destructive tests to determine compliance with paragraph STANDARDS OF ACCEPTANCE.

3.5 CORRECTIONS AND REPAIRS

When inspection or testing indicates defects in the weld joints, the welds shall be repaired using a qualified welder or welding operator as applicable. Corrections shall be in accordance with the requirements of AWS D1.1 and the specifications. Defects shall be repaired in accordance with the approved procedures. Defects discovered between passes shall be repaired before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, the affected area shall be blended into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before rewelding, the area shall be examined by suitable methods to insure that the defect has been eliminated. Repair welds shall meet the inspection requirements for the original welds. Any indication of a defect shall be regarded as a defect, unless reevaluation by nondestructive methods or by surface conditioning shows that no unacceptable defect is present.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION WELDING, STRUCTURAL				CONTRACTOR									SPEC. SECTION 05055	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.4 SUBMITTALS										
			SD-08 Statements										
		1	Welding Procedure Qualifications; FIO.										
		2	Welder, Welding Operator, and Tacker Qualification; GA.										
		3	Inspector Qualification; GA.										
			SD-18 Records										
		4	Quality Control; FIO.										

***** SAFETY PAYS *****

SECTION 05120

STRUCTURAL STEEL
09/97

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--END OF SECTION-- 05120-5

SECTION 05120

STRUCTURAL STEEL
09/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Manual	(1989) Manual of Steel Construction Allowable Stress Design
AISC ASD/LRFD Vol II	(1992) Manual of Steel Construction Vol II: Connections

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 6/A 6M	(1996b) General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A 36/A 36M	(1996) Carbon Structural Steel
ASTM A 53	(1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 242/A 242M	(1993a) High-Strength Low-Alloy Structural Steel
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 325M	(1993) High-Strength Bolts for Structural Steel Joints (Metric)
ASTM A 490M	(1993) High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A 500	(1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(1993) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 514/A 514M	(1994a) High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM A 563M	(1993) Carbon and Alloy Steel Nuts (Metric)
ASTM A 572/A 572M	(1994c) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 588/A 588M	(1994) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm)

	Thick
ASTM A 709/A 709M	(1996) Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched-and-Temper ed Alloy Structural Steel Plates for Bridges
ASTM A 852/A 852M	(1994) Quenched and Tempered Low-Alloy Structural Steel Plate with 70 ksi (485 MPa) Minimum Yield Strength to 4 in. (100 mm) Thick
ASTM F 436M	(1993) Hardened Steel Washers (Metric)
ASTM F 844	(1990) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F 959	(1996) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.21.1	(1994) Lock Washers (Inch Series)
ASME B46.1	(1995) Surface Texture (Surface Roughness, Waviness, and Lay)

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1993) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1	(1996) Structural Welding Code - Steel

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)

1.2 GENERAL REQUIREMENTS

Structural steel fabrication and erection shall be performed by an organization experienced in structural steel work of equivalent magnitude. The Contractor shall be responsible for correctness of detailing, fabrication, and for the correct fitting of structural members. Connections, for any part of the structure not shown on the contract drawings, shall be considered simple shear connections and shall be designed and detailed in accordance with pertinent provisions of AISC ASD Manual and AISC LRFD Vol II. Substitution of sections or modification of connection details will not be accepted unless approved by the Contracting Officer. AISC ASD Manual and AISC ASD/LRFD Vol II shall govern the work. Welding shall be in accordance with AWS D1.1. High-strength bolting shall be in accordance with AISC ASD Manual.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Structural Steel System; GA.

Structural Connections; GA.

Shop and erection details including members (with their connections) not shown on the contract drawings. Welds shall be indicated by standard welding symbols in accordance with AWS A2.4.

SD-08 Statements

Erection; GA.

Prior to erection, erection plan of the structural steel framing describing all necessary temporary supports, including the sequence of installation and removal.

SD-13 Certificates

Mill Test Reports; FIO.

Certified copies of mill test reports for structural steel, structural bolts, nuts, washers and other related structural steel items, including attesting that the structural steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation.

Welder Qualifications; FIO.

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.1.

Fabrication; FIO.

A copy of the AISC certificate indicating that the fabrication plant meets the specified structural steelwork category.

SD-14 Samples

High Strength Bolts and Nuts; FIO.

Carbon Steel Bolts and Nuts; FIO.

Nuts Dimensional Style; FIO. Washers; FIO.

Random samples of bolts, nuts, and washers as delivered to the job site if requested, taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

1.4 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

2.1.1 Carbon Grade Steel

Carbon grade steel shall conform to ASTM A 36/A 36M.

2.1.2 High-Strength Low-Alloy Steel

High-strength low-alloy steel shall conform to ASTM A 572/A 572M, Grade 50.

2.1.3 NOT USED.

2.1.4 NOT USED.

2.1.5 Carbon and High-Strength Low-Alloy Steel

Carbon and high-strength low-alloy steel shall conform to ASTM A 709/A 709M.

2.1.6 NOT USED.

2.2 STRUCTURAL TUBING

Structural tubing shall conform to ASTM A 500, Grade B.

2.3 STEEL PIPE

Steel pipe shall conform to ASTM A 53, Type E or S, Grade B.

2.4 NOT USED.

2.5 HIGH STRENGTH BOLTS AND NUTS

High strength bolts shall conform to ASTM A 325M, Type 1 with carbon steel nuts conforming to ASTM A 563M, Grade C, Type 3 with carbon steel nuts conforming to ASTM A 563M.

2.6 CARBON STEEL BOLTS AND NUTS

Carbon steel bolts shall conform to ASTM A 307, Grade A with carbon steel nuts conforming to ASTM A 563M, Grade A.

2.7 NUTS DIMENSIONAL STYLE

Carbon steel nuts shall be Hex or Heavy Hex style when used with ASTM A 307 bolts or Heavy Hex style when used with ASTM A 325M or ASTM A 490M bolts.

2.8 WASHERS

Plain washers shall conform to ASTM F 844. Other types, when required, shall conform to ASME B18.21.1 ASTM F 436M.

2.9 PAINT

Paint shall conform to SSPC Paint 25, except surfaces to be fireproofed shall be coordinated with specification section 07250 SPRAY APPLIED FIREPROOFING.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC ASD Manual. Fabrication and assembly shall be done in the shop to the greatest extent possible. The fabricating plant shall be certified under the AISC quality certification program for Category SBD structural steelwork. Compression joints depending on contact bearing shall have a surface roughness not in excess of 13 micrometer as determined by ASME B46.1, and ends shall be square within the tolerances for milled ends specified in ASTM A 6/A 6M. Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with AISC ASD Manual and primed with the specified paint.

3.2 ERECTION

Erection of structural steel shall be in accordance with the applicable provisions of AISC ASD Manual.

3.2.1 Structural Connections

Anchor bolts and other connections between the structural steel and foundations shall be provided and shall be properly located and built into connecting work. Field welded structural connections shall be completed before load is applied.

3.2.2 Base Plates and Bearing Plates

Column base plates for columns and bearing plates for beams, girders, and similar members shall be provided. Base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed and properly positioned, but prior to placing superimposed loads. Separate setting plates under column base plates will not be permitted. The area under the plate shall be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.2.3 Field Priming

After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION STRUCTURAL STEEL				CONTRACTOR									SPEC. SECTION 05120	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-04 Drawings										
		1	Structural Steel System; GA.										
		2	Structural Connections; GA.										
			SD-08 Statements										
		3	Erection; GA.										
			SD-13 Certificates										
		4	Mill Test Reports; FIO.										
		5	Welder Qualifications; FIO.										
		6	Fabrication; FIO.										
			SD-14 Samples										
		7	High Strength Bolts and Nuts; FIO.										
		8	Carbon Steel Bolts and Nuts; FIO.										
		9	Nuts Dimensional Style; FIO.										
		10	Washers; FIO.										

***** SAFETY PAYS *****

SECTION 05210

STEEL JOISTS
08/97

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1.2 SUBMITTALS 05210-1
1.3 DESCRIPTION 05210-1
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2.4 ACCESSORIES AND FITTINGS 05210-2
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PART 3 EXECUTION 05210-2
3.1 ERECTION 05210-2
3.2 BEARING PLATES 05210-2
--End of Section-- 05210-2

SECTION 05210

STEEL JOISTS
08/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

STEEL JOIST INSTITUTE (SJI)

SJI-01	(1994) Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Steel Joists; GA.

Detail drawings shall include fabrication and erection details, specifications for shop painting, and identification markings of joists. Members and connections for any portion of the structure not shown on the contract drawings shall be designed and stamped by a registered professional engineer and detailed on the shop drawings. Design computations for all Contractor designed members and connections must accompany the shop drawings.

SD-13 Certificates

Steel Joists; GA.

Certificates stating that the steel joists have been designed and manufactured in accordance with SJI-01. Complete engineering design computations may be submitted in lieu of the certification.

1.3 DESCRIPTION

Steel joists are designated on the drawings in accordance with the standard designations of the Steel Joist Institute. Joists of other standard designations or joists with properties other than those shown may be substituted for the joists designated provided the structural properties are equal to or greater than those of the joists shown and provided all other specified requirements are met.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition and stored off the ground in a well drained location, protected from damage, and easily accessible for inspection and handling.

PART 2 PRODUCTS

2.1 OPEN WEB STEEL JOISTS

Open web steel joists shall conform to SJI-01, K-Series. Joists shall be designed to support the loads given in the standard load tables of SJI-01.

2.2 LONGSPAN STEEL JOISTS

Joists designated LH and DLH shall be designed to support the loads given in the applicable standard load tables of SJI-01.

2.3 NOT USED.

2.4 ACCESSORIES AND FITTINGS

Accessories and fittings, including end supports and bridging, shall be in accordance with the standard specifications under which the members were designed.

2.5 SHOP PAINTING

Joists and accessories shall be shop painted with a rust-inhibiting primer paint. For joists which will be finish painted under Section 09900 PAINTING, GENERAL, the primer paint shall be limited to a primer which is compatible with the specified finish paint. Surfaces to be fireproofed shall be coordinated with specification section 07250 SPRAY APPLIED FIREPROOFING.

PART 3 EXECUTION

3.1 ERECTION

Installation of joists shall be in accordance with the standard specification under which the member was produced. Joists shall be handled in a manner to avoid damage. Damaged joists shall be removed from the site, except when field repair is approved and such repairs are satisfactorily made in accordance with the manufacturer's recommendations. Joists shall be accurately set, and end anchorage shall be in accordance with the standard specification under which the joists were produced. For spans over 12 m through 18 m one row of bridging nearest midspan shall be bolted diagonal bridging; for spans over 18 m bolted diagonal bridging shall be used instead of welded horizontal bridging. Joist bridging and anchoring shall be secured in place prior to the application of any construction loads. Any temporary loads shall be distributed so that the carrying capacity of any joist is not exceeded. Loads shall not be applied to bridging during construction or in the completed work. Abraded, corroded, and field welded areas shall be cleaned and touched up with the same type of paint used in the shop painting.

3.2 BEARING PLATES

Bearing plates shall be provided with full bearing after the supporting members have been plumbed and properly positioned, but prior to placing superimposed loads. The area under the plate shall be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout shall be as specified in Section 03300 CONCRETE FOR BUILDING CONSTRUCTION.

-- End of Section --

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION STEEL JOIST				CONTRACTOR									SPEC. SECTION 05210	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-04 Drawings										
		1	Steel Joists; GA.										
			SD-13 Certificates										
		2	Steel Joists; GA.										

***** SAFETY PAYS *****

SECTION 05300

STEEL DECKING

PART 1 GENERAL 05300-1
1.1 REFERENCES 05300-1
1.2 SUBMITTALS 05300-2
1.3 DELIVERY, STORAGE, AND HANDLING 05300-3

PART 2 PRODUCTS 05300-3
2.1 DECK UNITS 05300-3
2.2 TOUCH-UP PAINT 05300-3
2.3 ADJUSTING PLATES 05300-3
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3.1 ERECTION 05300-4
3.2 ATTACHMENTS 05300-4
3.4 HOLES AND OPENINGS 05300-5
3.5 PREPARATION OF FIRE-PROOFED SURFACES 05300-5
--END OF SECTION-- 05300-5

***** SAFETY PAYS *****

SECTION 05300

STEEL DECKING

10/89

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC-04	(1989) Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-673	(1987) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 108	(1993) Steel Bars, Carbon, Cold Finished, Standard Quality
ASTM A 446M	(1993) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
ASTM A 525	(1993) General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 570M	(1992; R 1993) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM A 611	(1994) Steel, Sheet, Carbon, Cold-Rolled, Structural Quality
ASTM A 780	(1993a) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM A 792M	(1993a) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process, General Requirements
ASTM C 423	(1990a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 795	(1993) Mounting Test Specimens During Sound Absorption Tests

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1994) Structural Welding Code - Steel

AWS D1.3	(1989) Structural Welding Code - Sheet Steel

STEEL DECK INSTITUTE (SDI)

SDI-02	(1987; Amended 1991) Diaphragm Design Manual
SDI Pub No 28	(1992) Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor Deck with Electrical Distribution

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 20	(1991) Zinc-Rich Primers (Type I - Inorganic and Type II - Organic)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-01 Data

Deck Units; GA.

Design computations for the structural properties of the deck units or SDI certification that the units are designed in accordance with SDI specifications. Design computations for the roof deck and attachments shall be provided for the uplift loads as indicated on the drawings which may exceed the minimum requirements.

SD-04 Drawings

Deck Units; GA.

Accessories; FIO.

Attachments; FIO.

Holes and Openings; FIO.

Drawings shall include type, configuration, structural properties, location, and necessary details of deck units, accessories, and supporting members; size and location of holes to be cut and reinforcement to be provided; location and sequence of welded or fastener connections; and the manufacturer's erection instructions.

SD-13 Certificates

Deck Units; FIO.

Attachments; FIO.

Manufacturer's certificates attesting that the decking material meets the specified requirements. Manufacturer's certificate attesting that the operators are authorized to use the low-velocity piston tool.

SD-14 Samples

Deck Units; FIO.

Accessories; FIO.

A 0.6 sq. meter sample of the decking material to be used, along with a sample of each of the accessories used. A sample of acoustical material to be used shall be included.

SD-18 Statements

Attachments; FIO.

Prior to welding operations, copies of qualified procedures and lists of names and identification symbols of qualified welders and welding operators.

1.3 DELIVERY, STORAGE, AND HANDLING

Deck units shall be delivered to the site in a dry and undamaged condition, stored off the ground with one end elevated, and stored under a weathertight covering permitting good air circulation. Finish of deck units shall be maintained at all times by using touch-up paint whenever necessary to prevent the formation of rust.

PART 2 PRODUCTS

2.1 DECK UNITS

Deck units shall conform to SDI Pub No 28. Panels of maximum possible lengths shall be used to minimize end laps. Fabricate deck units in lengths to span 3 or more supports with flush, telescoped, or nested 50 mm laps at ends, and interlocking, or nested side laps, unless otherwise indicated. Deck with cross-sectional configuration differing from the units indicated may be used, provided that the properties of the proposed units, determined in accordance with AISI SG-673, are equal to or greater than the properties of the units indicated and that the material will fit the space provided without requiring revisions to adjacent materials or systems.

2.1.1 Roof Deck

Steel deck used in conjunction with insulation and membrane roofing or standing seam and corrugated roofing shall conform to ASTM A 446M. Roof deck units shall be fabricated of the steel design thickness required by the design drawings as a minimum and shall be zinc-coated in conformance with ASTM A 525, G90 coating class.

2.1.2 Form Deck

Deck used as a permanent form for concrete shall conform to ASTM A 446M. Deck used as a form for concrete shall be fabricated of the steel design thickness required by the design drawings, and shall be painted with one coat of manufacturer's standard paint.

2.2 TOUCH-UP PAINT

Touch-up paint for shop-painted units shall be of the same type used for the shop painting, and touch-up paint for zinc-coated units shall be an approved galvanizing repair paint with a high-zinc dust content. Welds shall be touched-up with paint conforming to SSPC Paint 20 in accordance with ASTM A 780. Finish of deck units and accessories shall be maintained by using touch-up paint whenever necessary to prevent the formation of rust.

2.3 ADJUSTING PLATES

Adjusting plates or segments of deck units shall be provided in locations too narrow to accommodate full-size units. As far as practical, the plates shall be the same thickness and configuration as the deck units.

2.4 CLOSURE PLATES

2.4.1 Closure Plates for Roof Deck

Voids above interior walls shall be closed with sheet metal as indicated. Open deck cells at parapets, end walls, eaves, and openings through roofs shall be closed with sheet metal. Sheet metal shall be same thickness as deck units.

2.4.1.1 Cover Plates to Close Panels

Cover plates to close panel edge and end conditions and where panels change direction or abut. Butt joints in composite steel deck may receive a tape joint cover.

2.4.1.2 Column Closures to Close Openings

Column closures to close openings between steel deck and structural steel columns.

2.4.1.3 Sheet Metal

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.5 ACCESSORIES

The manufacturer's standard accessories shall be furnished as necessary to complete the deck installation. Metal accessories shall be of the same material as the deck and have minimum design thickness as follows: saddles, 1.204 mm; welding washers, 1.519 mm; cant strip, 0.749 mm; other metal accessories, 0.909 mm; unless otherwise indicated. Accessories shall include but not be limited to saddles, welding washers, cant strips, butt cover plates, underlapping sleeves, and ridge and valley plates.

PART 3 EXECUTION

3.1 ERECTION

Erection of deck and accessories shall be in accordance with SDI Pub No 28 and the approved detail drawings. Damaged deck and accessories including material which is permanently stained or contaminated, with burned holes or deformed shall not be installed. The deck units shall be placed on secure supports, properly adjusted, and aligned at right angles to supports before being permanently secured in place. The deck shall not be filled with concrete, used for storage or as a working platform until the units have been secured in position. Loads shall be distributed by appropriate means to prevent damage during construction and to the completed assembly. The maximum uniform distributed storage load shall not exceed the design live load. There shall be no loads suspended directly from the steel deck.

3.2 ATTACHMENTS

All fasteners shall be installed in accordance with the manufacturer's recommended procedure, except as otherwise specified. The deck units shall be attached to supports as indicated on the design drawings and in accordance with requirements of SDI Pub No 28. All welding of steel deck shall be in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturer of the steel deck being used. Welds shall be made only by operators previously qualified by tests prescribed in AWS D1.3 to perform the type of work required. Welding washers shall not be used at the connections of the deck to supports. Welding washers shall not be used at

sidelaps. Holes and similar defects will not be acceptable. Deck ends shall be lapped 50 mm. All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI-02.

3.4 HOLES AND OPENINGS

All holes and openings required shall be coordinated with the drawings, specifications, and other trades. Holes and openings shall be drilled or cut, reinforced and framed as indicated on the drawings or described in the specifications and as required for rigidity and load capacity. Holes and openings less than 150 mm across require no reinforcement. Holes and openings 150 to 300 mm across shall be reinforced by 1.204 mm thick steel sheet at least300 mm wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 150 on center. Holes and openings larger than 300 mm shall be reinforced by steel angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Steel angles shall be installed perpendicular to the deck ribs and shall be fastened to the angles perpendicular to the steel joists. Openings must not interfere with seismic members such as chords and drag struts.

3.5 PREPARATION OF FIRE-PROOFED SURFACES

Deck surfaces, both composite and noncomposite, which are to receive sprayed-on fireproofing, shall be galvanized and shall be free of all grease, mill oil, paraffin, dirt, salt, and other contaminants which impair adhesion of the fireproofing. Any required cleaning shall be done prior to steel deck installation using a cleaning method that is compatible with the sprayed-on fireproofing.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION				CONTRACTOR									SPEC. SECTION 05300	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Deck Units; GA.										
			SD-04 Drawings										
		2	Deck Units; GA.										
		3	Accessories; FIO.										
		4	Attachments; FIO.										
		5	Holes and Openings; FIO.										
			SD-13 Certificates										
		6	Deck Units; FIO.										
		7	Attachments; FIO.										
			SD-14 Samples										
		8	Deck Units; FIO.										
		9	Accessories; FIO.										
			SD-18 Statements										
		10	Attachments; FIO.										

***** SAFETY PAYS *****

SECTION 05400

COLD FORMED STEEL FRAMING
07/92

PART 1 GENERAL 05400-1
1.1 REFERENCES 05400-1
1.2 SUBMITTALS 05400-2
1.3 DELIVERY, HANDLING AND STORAGE 05400-2

PART 2 PRODUCTS 05400-3
2.1 COLD-FORMED STEEL FRAMING 05400-3
2.2 GYPSUM WALLBOARD 05400-4
2.3 PLYWOOD SHEATHING 05400-4
2.4 CONNECTIONS 05400-4

PART 3 EXECUTION 05400-4
3.1 GENERAL INSTALLATION REQUIREMENTS 05400-4
3.2 COLD-FORM STEEL 05400-4
3.3 GYPSUM WALLBOARD 05400-5
--End of Section-- 05400-5

*** SAFETY PAYS ***

SECTION 05400

COLD FORMED STEEL FRAMING
07/92

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC-03 (1989)Manual of Steel Construction Allowable Stress Design

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-671 (1986; Addenda 1989; Errata Nov 30, 1990) Specification for the Design of Cold-Formed Steel Structural Members (Part I of the Cold-Formed Steel Design Manual)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36 (1993a) Structural Steel

ASTM A 123 (1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153 (1982; R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 653M (1994) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality

ASTM A 525 (1993) General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

ASTM A 924 General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

ASTM C 79 (1994) Gypsum Sheathing Board

ASTM C 578 (1992) Rigid, Cellular Polystyrene Thermal Insulation

ASTM C 591 (1985) Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation

ASTM C 665 (1991) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

ASTM C 954 (1993) Steel Drill Screws for the Appplication of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

ASTM C 955 (1994) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases

ASTM C 1002 (1993) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING(ASHRAE)

ASHRAE-03 (1993; Errata) Handbook, Fundamentals I-P Edition

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3 (1989) Structural Welding Code - Sheet Steel

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1983) Construction and Industrial Plywood

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-01 Data

Cold Form Steel Framing; GA.

Calculations or tabular data as necessary, demonstrating the structural performance of the cold-formed steel framing system for the specified loadings and deflection criteria in accordance with the provisions of AISI SG-671.

SD-04 Drawings

Cold Form Steel Framing; GA.

Details of cold-formed steel framing and support around openings, including framing connections, attachment to other building elements and bridging. Drawings shall indicate thickness, material, dimensions, protective coatings, and section properties of all steel studs and other cold-formed steel framing members. Drawings shall also indicate size and type of all fasteners including size and type of all welds.

Insulation; FIO.

Gypsum Sheathing; FIO.

Welders Qualification; FIO.

Certificates stating that the materials and welders meet the requirements herein specified. Each certificate shall be signed by an authorized certification official and shall include their organization and position and shall identify the products covered under their certifying signature.

1.3 DELIVERY, HANDLING AND STORAGE

Materials shall be delivered and handled in a manner to avoid chipping, breakage, bending or other damage and to avoid contact with soil or other contaminating materials. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust. Insulation, moisture barrier, and gypsum sheathing shall be stored in dry, well ventilated, weather-tight areas protected from sunlight and excessive heat. Air infiltration type vapor barrier shall be stored in accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.1 COLD-FORMED STEEL FRAMING

Cold-formed framing shall consist of steel studs, top and bottom tracks, runners, horizontal bridging, joi6ts, tension straps and other cold-formed members and other accessories. The cold-formed framing system shall be designed in accordance with AISI SG-671. The steel studs and other cold-formed steel framing members within the wall shall be designed to resist the seismic loadings acting inward and outward perpendicular and a lateral "wind" pressure of 270 Pascals (5 pounds per square foot) to the wall system without exceeding a deflection of 1/600 times the vertical stud span and AISI SG-671 allowable stresses. Design calculations shall be submitted for approval. All members and components made of sheet steel shall be hot-dip galvanized in accordance with ASTM A 525 with a minimum coating thickness of G 60. Metal framing for interior partitions are specified in Section 09250 GYPSUM WALLBOARD. The design of the cold-formed steel framing system shall be completed and stamped by a Professional Engineer.

2.1.1 Cold-Formed Steel Studs

Studs will conform to ASTM A 653-94, Grade 50, having a minimum yield strength of 345 MPA (50,000 psi). All steel studs should have a minimum depth of 150 mm with the exception of the studs surrounding second story stairwells shall have a mini = depth of 92 mm. All studs shall have a minimum flange width of 41 mm with a minimum return lip of 13 mm. All stud walls should be designed in accordance with AISI SG-671.
All nested studs shall conform to ASTM A 653-94 and ASTM A 924, with a minimum yield strength of 275 MPA (40,000 psi). All nested studs should have a minimum thickness of 0.9 mm or heavier with a minimum depth of 150 mm, minimum flange width of 45 m, and minimum return lip of 13 mm. All stud walls should be designed in accordance with AISI SG-671.

2.1.2 Cold-Form Steel Joists

All second floor ceiling framing cold-formed steel joists, with the exception of the special design section on sheet S-4, shall conform to ASM A 653-94 and ASTM A 924 having the following minimum properties: minimum yield strength of 345 MPA (50,000 psi), thickness of 1.44 mm, depth of 303 mm, flange width 41 mm, and return lip of 16 mm.

The second floor ceiling framing cold-formed steel joists for the special design section on sheet S-4 and all second floor steel joist framing, shall have the following minimum properties: yield strength of 345 MPA (50,000 psi), thickness of 1.8 mm, depth of 303 mm, flange width of 64 mm and return lip of 16 mm.
All cold-formed steel joists shall not exceed the following deflection criteria:

1 times the joist span for all dead and live loads, and;
240
1 times the joist span for all live loads.
360

All cold-formed steel tension straps used for lateral bracings of walls shall conform to ASTN A 653-94 and ASTN A 924 and should have the following minimum properties: yield strength of 230 NPA (33,000 psi), width of 127 mm, and thickness of 1.4 mm. The weld length at each end of strap must be of adequate length to fully develop tension capacity of the strap.

2.1.3 Runners, Tracks, Bridging and Accessories

All cold-formed steel sheet framing members, components, and accessories, other than the steel studs, joists, and tension straps shall conform to ASTM C 955 and be of steel conforming to ASTM A 466, Grade 653, having a minimum yield strength of 345 NPA (50,000 psi).

2.2 GYPSUM WALLBOARD

Gypsum wallboard that is installed on the interior side of the cold-formed steel framing system shall be as specified in Section 09250 GYPSUM WALLBOARD.

2.3 PLYWOOD SHEATHING

Plywood sheathing that is installed on the top of the cold-formed steel joists system shall have a minimum thickness of 13 mm and shall be 1.2 m. Plywood sheathing shall be in accordance with DOC PS 1, as specified in Section 06200, ROUGH CARPENTRY.

2.4 CONNECTIONS

Screws, bolts and anchors shall be hot-dip galvanized in accordance with ASTM A 123 or ASTM A 153 as appropriate.

2.4.1 Framing Screws, Bolts and Anchors

Screws, bolts and anchors used in the assembly of the cold-formed steel framing system shall be as required by design of the framing system for the specified loading. Screw, bolt and anchor sizes shall be shown on the detail drawings.

2.4.2 Welding

All welded connections shall be designed and all welding shall be performed in accordance with AWS D1.3, as modified by AISI SG-671. All welders shall be qualified in accordance with AWS D1.3. All welds shall be cleaned and touched-up with zinc-rich paint.

2.4.3 Gypsum Sheathing Screws

Screws for attachment of gypsum sheathing to cold-formed steel framing shall conform to ASTM C 954.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Wall sections, types of construction and dimensions shall be as shown. Metal door and window frames and other special framing shall be built and anchored into the wall system as indicated.

3.2 COLD-FORM STEEL

All details for affixing steel studs to runners and all other sheet steel framing members along with all details necessary for anchorage of the steel stud wall system to the building structural systems shall be shown on the drawings. Horizontal bridging shall be provided as indicated on drawings. Studs shall be spaced 400 mm on center. Coordinate stud spacing with sheathing and anchor requirements. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on

each side of the opening with self-drilling screws. Double studs shall be provided at both jambs of all door openings.

3.3 GYPSUM WALLBOARD

Gypsum wallboard shall be installed on both sides of the cold-formed steel stud walls where feasible. Installation shall be as specified in Section 09250 GYPSUM WALLBOARD except at vertical slip joints, the gypsum wallboard shall be connected to the vertical studs only so as not to prevent movement at the slip joint.

--End of Section--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION COLD FORMED STEEL FRAMING					CONTRACTOR								SPEC. SECTION 05400	
						CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Cold Form Steel Framing; GA.										
			SD-04 Drawings										
		2	Cold Form Steel Framing; GA.										
		3	Insulation; FIO.										
		4	Gypsum Sheathing; FIO.										
		5	Welders Qualification; FIO.										

SECTION 05500

05500 MISCELLANEOUS METAL

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1.1 REFERENCES 05500-1
1.2 SUBMITTALS 05500-1
1.3 GENERAL REQUIREMENTS 05500-2
1.4 DISSIMILAR MATERIALS 05500-2
1.5 WORKMANSHIP 05500-2
1.6 ANCHORAGE 05500-2

PART 2 PRODUCTS 05500-3
2.1 ALUMINUM FINISHES 05500-3
2.2 SHOP PAINTING 05500-3
2.3 ACCESS DOORS AND PANELS 05500-3
2.4 PIPE GUARDS 05500-3
2.5 DOWNSPOUT BOOTS 05500-3
2.6 EXPANSION JOINT COVERS 05500-3
2.7 HANDRAILS AND GUARDRAILS 05500-3
2.8 LADDERS 05500-4
2.9 MIRROR FRAMES 05500-4
2.10 MISCELLANEOUS 05500-4
2.11 PARTITIONS, DIAMOND MESH TYPE 05500-5
2.12 ROOF HATCHES 05500-5
2.13 SAFETY CHAINS 05500-5
2.14 SAFETY NOSING 05500-5
2.15 STEEL STAIRS 05500-5
2.16 AREAWAY GRATINGS AND FRAMES 05500-5

PART 3 EXECUTION 05500-6
3.1 GENERAL REQUIREMENTS 05500-6
3.2 REMOVABLE ACCESS PANELS 05500-6
3.3 PIPE GUARDS 05500-6
3.4 INSTALLATION OF DOWNSPOUT BOOTS 05500-6
3.5 ATTACHMENT OF HANDRAILS AND GUARDRAILS 05500-6
3.6 PARTITION POSTS AND OPENINGS 05500-6
3.7 MOUNTING OF SAFETY CHAINS 05500-6
3.8 INSTALLATION OF SAFETY NOSINGS 05500-7

SAFETY PAYS

SECTION 05500

MISCELLANEOUS METAL
08/94

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A14.3	(1992) Ladders - Fixed - Safety Requirements

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1996) carbon Structural Steel
ASTM A 53	(1996) Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 653	(1996) Steel Sheet, Zinc-Coated or Zinc Iron Alloy Coated (Galvanized) by the Hot-Dip Process.
ASTM A 924	(1996a) Steel Sheet, Metallic Coated by the Hot-Dip Process
ASTM B 26	(1996a) Aluminum-Alloy Sand Castings
ASTM B 429	(1995) Aluminum-Alloy Extruded Structural Pipe and Tube

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1994) Structural Welding Code - Steel

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531	(1993) Metal Bar Grating Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Miscellaneous Metal Items; GA.

Detail drawings indicating material thickness, type, grade, and class; 61 dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for the following items: access doors and panels, handrails (steel and aluminum), safety nosings, steel stairs, expansion joint covers and storage cages.

SD-14 Samples

Miscellaneous Metal Items; GA.

Samples of the following items: access doors and panels, handrails (steel and aluminum), safety nosings, steel stairs, expansion joint covers and storage cages. Samples shall be full size, taken from manufacturer's stock, and shall be complete as required for installation in the structure. After approval, samples may be installed in the work, provided each sample is clearly identified and its location recorded.

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123, ASTM A 653, or ASTM A 924, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place.

Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, 71 and power-driven fasteners when approved for concrete; toggle bolts and 72 through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

PART 2 PRODUCTS

2.1 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have standard mill finish.

2.2 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

2.3 ACCESS DOORS AND PANELS

Doors and panels shall be flush type unless otherwise indicated. Frames for access doors shall be fabricated of not lighter than 1.519 mm steel with welded joints and finished with anchorage for securing into construction. Access doors shall be a minimum of 300 by 300 mm unless otherwise indicated and of not lighter than 1.897 mm steel, with stiffened edges, complete with attachments. Access doors shall be hinged to frame and provided with a flush face, screw driver operated latch. Exposed metal surfaces unless otherwise indicated shall have a baked enamel finish of color that matches adjacent surface.

2.4 PIPE GUARDS

Pipe guards shall be heavy duty steel pipe conforming to ASTM A 53, Type E or S, weight STD, black finish.

2.5 DOWNSPOUT BOOTS

Downspout boots shall be cast iron with receiving bells sized to fit downspouts.

2.6 EXPANSION JOINT COVERS

Expansion joint covers shall be constructed of extruded aluminum with anodized satin finish for walls and ceilings and with standard mill finish for floor covers and exterior covers. Plates, backup angles, expansion filler strip and anchors shall be designed as indicated. Expansion joint system shall provide a one hour rating.

2.7 HANDRAILS AND GUARDRAILS

Handrails and guardrails shall be designed to resist a concentrated load of 890 N in any direction at any point of the top of the rail or 292 Newtons per meter applied horizontally to top of the rail, whichever is more severe.

2.7.1 Aluminum Handrails and Guardrails

Handrails and guardrails shall consist of 50 mm nominal Schedule 40 pipe ASTM B 429. Railings shall be anodized aluminum dark bronze color. All fasteners shall be Series 300 stainless steel.

a. Fabrication: Jointing shall be by one of the following methods:

(1) Flush type rail fittings, welded and ground smooth with splice locks secured with 9.5 mm recessed head setscrews.

(2) Mitered and welded joints, made by fitting post to top rail and intermediate rail to post and corners, shall be groove welded and ground smooth. Splices, where allowed by the Contracting Officer, shall be butted and reinforced by a tight fitting dowel or sleeve not less than 150 mm in length. Dowel or sleeve shall be connected to one side of the splice by tack welding or by using epoxy cement.

(3) Railings shall be assembled using slip-on aluminum-magnesium alloy fittings for joints. Fittings shall be fastened to pipe or tube with 6 mm or 10 mm stainless steel recessed head setscrews. Assembled railings shall be provided with fittings only at vertical supports or at rail terminations attached to walls. Expansion joints shall be at the midpoint of panels. A setscrew shall be provided in only one side of the slip-on sleeve. Alloy fittings shall conform to ASTM B 26.

2.7.2 Steel Handrails, Including Carbon Steel Inserts

Steel handrails, including inserts in concrete, shall be steel pipe conforming to ASTM A 53. Steel railings shall be 50 mm nominal size as indicated. Exterior railings shall be hot-dip galvanized and 60 mm. Interior railings shall be shop painted.

a. Fabrication: Joint posts, rail, and corners shall be fabricated by one of the following methods:

(1) Flush type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 10 mm hexagonal recessed-head setscrews.

(2) Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and reinforced by a tight fitting interior sleeve not less than 150 mm long.

(3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

b. Removable sections, toe-boards, and brackets shall be provided as indicated.

2.8 LADDERS

Ladders shall be galvanized steel, fixed rail type in accordance with ANSI A14.3.

2.9 MIRROR FRAMES

Frames for plate glass mirrors larger than 450 by 750 mm shall be fabricated from extruded aluminum with anodized finish. Frames shall be provided with concealed fittings and tamperproof mountings.

2.10 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, curb angles, BBQ grate, miscellaneous mountings, and frames, shall be provided to complete the work.

2.11 PARTITIONS, DIAMOND MESH TYPE

Partitions shall be constructed of metal fabric attached to structural steel framing members. Fabric shall be 10 gauge steel wires woven into 38 mm diamond mesh with wire secured through weaving channels. Framing members shall be channels 38 by 3 mm minimum size. Channel frames shall be mortised and tenoned at intersections. Steel frames, posts, and intermediate members shall be of the sizes and shapes indicated. Cast-iron floor shoes and caps shall have setscrew adjustment. Doors and grilles shall be provided as indicated, complete with hardware and accessories including sliding mechanisms, locks, guard plates, sill shelves and brackets, and fixed pin butts. Doors and grilles shall have cover plates as indicated. Dutch doors shall have a lock for each leaf. A continuous rubber bumper shall be provided at bottom of grille frame. Locks shall be bronze, cylinder (with removable core), mortise type. Keying shall be coordinated with Section 08700 BUILDERS' HARDWARE. All components shall have galvanized finish. Shop prime mesh partition fabric, framing and other componets to prepare for field painting.

2.12 ROOF HATCHES

Roof hatches shall be of aluminum with 75 mm beaded flange welded and ground at corners. Provide minimum clear opening of 940 by 760 mm. Cover and curb shall be insulated with 25 mm thick rigid insulation covered and protected by aluminum sheet. The curb shall be equipped with an integral metal cap flashing of the same gauge and metal as the curb, full welded and ground at corners for weathertightness. Hatches shall be completely assembled with heavy hinges, compression spring operators enclosed in telescopic tubes, positive snap latch with turn handles on inside and neoprene draft seal. Fasteners shall be provided for padlocking on the inside. The cover shall be equipped with an automatic hold-open arm complete with handle to permit one hand release.

2.13 SAFETY CHAINS

Safety chains shall be galvanized welded steel, proof coil chain in accordance with ASTM A 467 class C5. Safety chains shall be straight link style, 5 mm diameter, minimum 39 links per meter and with bolt type snap hooks on each end. Eye bolts for attachment of chains shall be galvanized 10 mm bolt with 19mm eye, anchored as indicated. Two chains shall be furnished for each guarded opening.

2.14 SAFETY NOSING

Safety nosings shall be of cast aluminum with plain, abrasive surface. Nosing shall be 75 mm wide and terminating at not more than 150 mm from the ends of treads, except nosing for metal pan cement-filled treads shall extend the full length of the tread. Safety nosings shall be provided with anchors not less than 19 mm long. Integrally cast mushroom anchors are not acceptable.

2.15 STEEL STAIRS

Steel stairs shall be complete with structural or formed channel stringers, metal pan cement-filled treads, landings, columns, aluminum handrails, and necessary bolts and other fastenings as indicated. Structural steel shall conform to ASTM A 36. Risers on stairs with metal pan treads shall be deformed to form a sanitary cove to retain the tread concrete. Integral nosings shall have braces extended into the concrete fill. Gratings for treads and landings shall conform to NAAMM MBG 531. Grating treads shall have slip-resistant nosings.

2.16 AREAWAY GRATINGS AND FRAMES

Aluminum or Stainless steel grating shall be designed in accordance with NAAMM MBG 531 to meet the

indicated load requirements. Edges shall be banded with bars 6 mm less in height than bearing bars for grating sizes above 19 mm. Banding bars shall be flush with the top of bearing grating. Frames shall be of welded steel construction finished to match the grating.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

3.2 REMOVABLE ACCESS PANELS

A removable access panel not less than 300 by 300 mm shall be installed directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible.

3.3 PIPE GUARDS

Pipe guards shall be set vertically in concrete piers. Piers constructed of, and the hollow cores of the pipe filled with, concrete specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.4 INSTALLATION OF DOWNSPOUT BOOTS

Downspouts shall be secured to building through integral lips with appropriate fasteners.

3.5 ATTACHMENT OF HANDRAILS AND GUARDRAILS

Brackets shall be installed where indicated. Splices, where required, shall be made at expansion joints. Removable sections shall be installed as indicated.

3.5.1 Installation of Aluminum Handrails and Guardrails

Installation shall be by means of flanges anchored to concrete or masonry by expansion shields. Bolts used to anchor aluminum alloy flanges shall be stainless steel of a size appropriate to the standard product of the manufacturer. Where aluminum or alloy fittings or extrusions are to be in contact with dissimilar metals or portland cement concrete, the contact surface shall be given a heavy coating of bituminous paint or asphalt varnish.

3.6 PARTITION POSTS AND OPENINGS

Posts shall be set in shoes bolted to the floor and in caps tap-screwed to clip angles in overhead construction, as indicated. Openings shall be formed using channels similar to the partition frames at ducts, pipes, and other obstructions.

3.7 MOUNTING OF SAFETY CHAINS

Safety chains shall be mounted 1070 mm and 610 mm above the floor.

3.8 INSTALLATION OF SAFETY NOSINGS

Nosing shall be completely embedded in concrete before the initial set of the concrete occurs and shall finish flush with the top of the concrete surface.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 05500
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO.	TRANS-MITTAL NO.	ITEM NO.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER	REV-IEW-ER	SUBMIT	APPROV. NEEDED BY	MATER. NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
a.	b.	c.	d. through q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
			PAR. NO. SD-04 Drawings										
			Miscellaneous Metal Items; GA.										
			SD-14 Samples										
			Miscellaneous Metal Items; GA.										

SAFETY PAYS

SECTION 06100

ROUGH CARPENTRY
09/96

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SECTION 06100

ROUGH CARPENTRY
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN FOREST AND PAPER ASSOCIATION (AFPA)

AFPA-T901	(1991; Supple 1993; Addenda April 1995) National Design Specification for Wood Construction
AFPA T11-WCD1	(1988) Manual for Wood Frame Construction

APA-THE ENGINEERED WOOD ASSOCIATION (APA)

APA E30	(1996) Design/Construction Guide, Residential and Commercial
APA E445	(1991; Rev Jan 1996) Performance Standards and Policies for Structural-Use Panels
APA V450	(1994; Rev. Apr 96) Source List - Adhesives for APA Glued Floor System

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM C 518	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties By Means of the Heat Flow Meter Apparatus
ASTM C 665	(1994) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 1136	(1992) Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM D 2898	(1994) Accelerated Weathering of Fire-Retardant -Treated Wood for Fire Testing
ASTM E 84	(1996a) Surface Burning Characteristics of Building Materials
ASTM E 96	(1996) Water Vapor Transmission of Materials

ASTM E 154	(1988; R 1993) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

AMERICAN WOOD PRESERVERS' ASSOCIATION (AWPA)

AWPA C2	(1995) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes
AWPA C9	(1995) Plywood - Preservative Treatment by Pressure Processes
AWPA C20	(1993) Structural Lumber - Fire-Retardant Treatment by Pressure Processes
AWPA C27	(1993) Plywood - Fire-Retardant Treatment by Pressure Processes
AWPA P5	(1996) Standards for Waterborne Preservatives

CODE OF FEDERAL REGULATION (CFR)

16 CFR 1209	Interim Safety Standard for Cellulose Insulation

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1	(1996) Voluntary Product Standard -Construction and Industrial Plywood

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA-01	(1993) Standard Grading Rules for Northeastern Lumber

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB-1001	(1994) Standard Grading Rules for Southern Pine Lumber

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17	(1993) Grading Rules for West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01	(1995; Supple No. 1-3) Western Lumber Grading Rules 95

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Structural wood members; GA.

Design analysis and calculations of fabricated wood trusses and other fabricated structural members showing design criteria used to accomplish the application analysis.

SD-04 Drawings

Structural wood members; GA.

Drawings of fabricated wood trusses and other fabricated structural members indicating materials, shop fabrication and field erection drawings including methods of fastening.

SD-13 Certificates

Grading and Marking; FIO.

Manufacturer's certificates (audited by an American Lumber Standards approved agency) attesting that lumber and material not normally grade marked or exempt from being grade marked meet the specified requirements. Certificate of Inspection issued for grade marked material by an American Lumber Standards Committee (ALSC) recognized lumber inspection agency prior to shipment.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 LUMBER AND SHEATHING

2.1.1 Grading and Marking

2.1.1.1 Lumber Products

Solid sawn and finger-jointed lumber shall bear an authorized gradestamp or grademark recognized by ALSC, or an ALSC recognized certification stamp, mark, or hammerbrand. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

2.1.1.2 Plywood and other Sheathing Products

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. Except for plywood, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.1.3 Fabricated Structural Members

Wood trusses shall be fabricated in accordance with TPI 1.

2.1.2 Sizes

Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Moisture Content

At the time lumber and other materials are delivered and when installed in the work their moisture content shall be as follows:

a. Treated and Untreated Lumber:

100 mm or less, nominal thickness, 19 percent maximum. 125 mm or more, nominal thickness, 23 percent maximum in a 75 mm perimeter of the timber cross-section.

b. Materials Other Than Lumber: In accordance with standard under which product is produced.

2.1.4 Treatment

2.1.4.1 Lumber and Timbers

Lumber and timbers shall be treated in accordance with AWPA C2 with waterborne salt based preservatives only to a retention level as follows:

a. 4 kg per cubic meter intended for above ground use.

2.1.4.2 Plywood

Plywood shall be treated in accordance with AWPA C9 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

a. 4 kg per cubic meter intended for above ground use.

b. 6.4 kg per cubic meter intended for ground contact and fresh water use.

2.1.5 Fire-Retardant Treatment

All concealed wood shall be fire-retardant treated. Fire-retardant treated wood shall be pressure treated in accordance with AWPA C20 for lumber and AWPA C27 for plywood. Material use shall be defined in AWPA C20 and AWPA C27 for Interior Type B and Exterior Type. Treatment and performance inspection shall be by an independent and qualified testing agency that establishes performance ratings. Each piece or bundle of treated material shall bear identification of the testing agency to indicate performance in accordance with such rating. Treated materials to be exposed to rain wetting shall be subjected to an accelerated weathering technique in accordance with ASTM D 2898 prior to being tested for compliance with AWPA C20 or AWPA C27. Items to be treated include: plywood and header plates of wood trusses.

2.1.6 Structural Wood Members

Species and grades shall be as listed in AFPA-T901. Structural lumber used in fabrication of bolted trusses and

other fabricated structural members for engineered uses, except laminated members, shall have allowable design values of 7.2 MPa in bending; 4.8 MPa in tension parallel to the grain; 2.1 MPa in compression perpendicular to the grain; 2.1 MPa in compression parallel to the grain; .4 MPa in horizontal shear; and a modulus of elasticity of .8275 MPa. Joists, rafters including trussed type, decking, and headers shall have design values of 8.3 MPa in bending for repetitive member uses. Design of members and fastenings shall conform to AITC-01. Other stress graded or dimensioned items such as blocking, carriages, and studs shall be standard or No. 2 grade except that studs may be Stud grade.

2.1.7 Sheathing

Sheathing shall be plywood, structural-use panels, or wood for wall sheathing; and plywood, structural-use panels.

2.1.7.1 Plywood

Plywood shall conform to DOC PS 1, Grade C-D with exterior glue. Sheathing for roof and walls without corner bracing of framing shall have a span rating of 16/0 or greater for supports 400 mm on center and a span rating of 24/0 or greater for supports 600 mm on center.

2.1.7.2 Structural-Use Panels

Panels shall meet the qualification requirements of APA E445 for rated sheathing, Exposure 1 or Structural I rated sheathing, Exposure 1. Sheathing for roofs or walls without corner bracing of framing shall have a span rating of 16/0 or greater for supports 400 mm on center and shall have a span rating of 24/0 or greater for supports 600 mm on center.

2.1.8 Miscellaneous Wood Members

2.1.8.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

Member	Size mm
Bridging	25 by 75 or 25 by 100 for use between members 50 by 300 and smaller; 50 by 100 for use between members larger than 50 by 300.
Corner bracing	25 by 100.
Furring	25 by 75
Nailing strips	25 by 75 or 25 by 100 when used as shingle base or interior finish, otherwise 50 mm stock.

2.1.8.2 Plates

Sill plates shall be standard or number 2 grade.

2.1.8.3 Blocking

Blocking shall be standard or number 2 grade.

2.1.8.4 Rough Bucks and Frames

Rough bucks and frames shall be straight standard or number 2 grade.

2.2 Not Used

2.3 ACCESSORIES AND NAILS

Markings shall identify both the strength grade and the manufacturer. Accessories and nails shall conform to the following:

2.3.1 Anchor Bolts

ASTM A 307, size as indicated, complete with nuts and washers.

2.3.2 Bolts: Lag, Toggle, and Miscellaneous Bolts and Screws

Type, size, and finish best suited for intended use. Finish options include zinc compounds, cadmium, and aluminum paint impregnated finishes.

2.3.3 Clip Angles

Steel, 4.8 mm thick, size best suited for intended use; or zinc-coated steel or iron commercial clips designed for connecting wood members.

2.3.4 Expansion Shields

Type and size best suited for intended use.

2.3.5 Metal Bridging

Optional to wood bridging; zinc-coated steel, size and design to provide rigidity equivalent to specified wood bridging.

2.3.6 Nails and Staples

ASTM F 547, size and type best suited for purpose. In general, 8-penny or larger nails shall be used for nailing through 25 mm thick lumber and for toe nailing 50 mm thick lumber; 16-penny or larger nails shall be used for nailing through 50 mm thick lumber. Nails used with treated lumber shall be galvanized. Nailing shall be in accordance with the recommended nailing schedule contained in AFPA T11-WCD1. For sheathing, length of nails shall be sufficient to extend 25 mm into supports. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in AFPA-T901. Reasonable judgement backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

2.3.7 Timber Connectors

Unless otherwise specified, timber connection shall be in accordance with TPI 1, APA EWS T300 or AITC-01.

2.4 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown. R-values shall be determined at 24 degrees C in accordance with ASTM C 518. Insulation shall contain the highest practicable percentage of recovered material which has been recovered or diverted from solid waste, but not including material reused in a manufacturing process. Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Materials containing more than one percent asbestos will not be allowed.

2.4.1 Batt or Blanket

2.4.1.1 Glass Fiber Batts and Rolls

Glass fiber batts and rolls shall conform to ASTM C 665, Type I unfaced insulation, Type II kraft faced insulation, Type III foil faced insulation, Class A, having a UL rating of 25 and a smoke developed rating of 150 or less when tested in accordance with ASTM E 84. Insulation shall have a 0.25 mm thick, white, puncture resistant woven-glass cloth with vinyl facing on one side. Width and length shall suit construction conditions.

2.4.1.2 Mineral Fiber Batt

Mineral fiber batt shall conform to ASTM C 665, Type I unfaced insulation, Type II kraft faced insulation, Class C, Type III foil faced insulation Class C.

2.4.1.3 Mineral Fiber Blanket

Mineral fiber blanket shall conform to ASTM C 553, Type I, Class 6. Blankets shall be sized to suit construction conditions, resilient type for use below and above ambient temperature to 195 degrees C. Blankets shall have a factory applied vapor-barrrier facing on one side with 50 mm nailing tabs on both edges. Vapor barriers shall be fire retardant, high vapor transmission, and aluminum foil laminated to crepe paper type conforming to ASTM C 1136, Type II. Mineral fibers shall be the textile type. Nominal density shall be 12 kg per cubic meter.

2.5 VAPOR RETARDER

Vapor retarder shall be polyethylene sheeting conforming to ASTM E 154or other equivalent material. Vapor retarder shall have a maximum vapor permeance rating of 29 ng per Pa per second per square meter as determined in accordance with ASTM E 96, unless otherwise specified.

2.6 AIR INFILTRATION BARRIER

Air infiltration barrier shall be building paper conforming to ASTM C 1136, Type IV, style optional or a tear and puncture resistant olefin building wrap (polyethylene or polypropylene) with a moisture vapor transmission rate of 125 g per square meter per 24 hours in accordance with ASTM E 96, Desiccant Method at 23 degrees C or with a moisture vapor transmission rate of 670 g per square meter per 24 hours in accordance with ASTM E 96, Water Method at 23 degrees C.

PART 3 EXECUTION

3.1 INSTALLATION OF FRAMING

3.1.1 General

Members shall be closely fitted, accurately set to required lines and levels, and rigidly secured in place. Members shall be framed for passage of ducts. Members shall be cut, notched, or bored in accordance with applicable requirements of AFPA-T901 for the passage of pipes, wires, or conduits. Rafters, purlins, and joists shall be set with crown edge up. Framing shall be kept at least 50 mm 2 inches away from chimneys and 100 mm 4 inches away from fireplace backwalls. When joists, beams, and girders are placed on masonry or concrete, a wood base plate shall be positioned and leveled with grout. The joist, beam, or girder shall then be placed on the plate. When joists, beams, and girders are set into masonry or concrete, a pocket shall be formed into the wall. The joist, beam, or girder shall then be placed into the pocket and leveled with a steel shim.

3.1.2 Structural Members

Members shall be adequately braced before erection. Members shall be aligned and all connections completed before removal of bracing. Individually wrapped members shall be unwrapped only after adequate protection by a roof or other cover has been provided. Scratches and abrasions of factory-applied sealer shall be treated with two brush coats of the same sealer used at the factory.

3.1.3 NOT USED

3.1.4 NOT USED

3.1.5 Roof Framing or Rafters

Tops of supports or rafters shall form a true plane. Valley, ridge, and hip members shall be of depth equal to cut on rafters where practicable, but in no case less than depth of rafters. Valleys, hips, and ridges shall be straight and true intersections of roof planes. Necessary crickets and watersheds shall be formed. Rafters, except hip and valley rafters, shall be spiked to wall plate and to ceiling joists with no less than three 8-penny nails. Rafters shall be toe-nailed to ridge, valley, or hip members with at least three 8-penny nails. Rafters shall be braced to prevent movement until permanent bracing, decking or sheathing is installed. Hip and valley rafters shall be secured to wall plates by clip angles. Openings in roof shall be framed with headers and trimmers. Unless otherwise indicated, headers carrying more than two rafters and trimmers supporting headers carrying more than one rafter shall be double. Hip rafters longer than the available lumber shall be butt jointed and scabbed. Valley rafters longer than the available lumber shall be double, with pieces lapped not less than 1200 mm 4 feet and well spiked together. Trussed rafters shall be installed in accordance with TPI-85.

3.2 INSTALLATION OF SHEATHING

3.2.1 Plywood and Structural-Use Panels

Sheathing shall be applied with edges 3 mm apart at side and end joints, and nailed at supported edges at 150 mm on center and at intermediate supports 300 mm on center. Nailing of edges shall be 10 mm from the edges. Wall sheathing shall extend over top and bottom plates, and if applied horizontally the vertical joints shall be made over supports and staggered.

3.3 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS

3.3.1 Bridging

Wood bridging shall have ends accurately bevel-cut to afford firm contact and shall be nailed at each end with two nails. Metal bridging shall be installed as recommended by the manufacturer. The lower ends of bridging shall be

driven up tight and secured after subflooring or roof sheathing has been laid and partition framing installed.

3.3.2 Corner Bracing

Corner bracing shall be installed when required by type of sheathing used or when siding, other than panel siding, is applied directly to studs. Corner bracing shall be let into the exterior surfaces of the studs at an angle of approximately 45 degrees, shall extend completely over wall plates, and shall be secured at each bearing with two nails.

3.3.3 Blocking

Blocking shall be provided as necessary for application of siding, sheathing, subflooring, wallboard, and other materials or building items, and to provide firestopping. Blocking for firestopping shall ensure a maximum dimension of 2.4 m for any concealed space. Blocking shall be cut to fit between framing members and rigidly nailed thereto.

3.3.4 Nailers and Nailing Strips

Nailers and nailing strips shall be provided as necessary for the attachment of finish materials. Nailers used in conjunction with roof deck installation shall be installed flush with the roof deck system. Stacked nailers shall be assembled with spikes or nails spaced not more than 450 mm on center and staggered. Beginning and ending nails shall not be more than 150 mm for nailer end. Ends of stacked nailers shall be offset approximately 300 mm in long runs and alternated at corners. Anchors shall extend through the entire thickness of the nailer. Strips shall be run in lengths as long as practicable, butt jointed, cut into wood framing members when necessary, and rigidly secured in place.

3.3.5 Wood Grounds

Wood grounds shall be provided as necessary for attachment of trim, finish, and other work to plaster. Grounds shall be run in lengths as long as practicable, butt jointed, and rigidly secured in place.

3.3.6 Furring Strips

Furring strips shall be provided at the locations shown. Furring strips shall be installed at 400 mm on center unless otherwise shown, run in lengths as long as practicable, butt jointed and rigidly secured in place.

3.3.7 Rough Bucks and Frames

Rough bucks shall be set straight, true, and plumb, and secured with anchors near top and bottom of each wood member and at intermediate intervals of not more than 900 mm. Anchors for concrete shall be expansion bolts, and anchors for masonry shall be 5 by 32 mm steel straps extending not less than 200 mm into the masonry and turned down 50 mm into the masonry.

3.3.8 Plates

Sill plates shall be set level and square and anchor bolted at not more than 1800 mm on centers and not more than 300 mm from end of each piece. A minimum of two anchors shall be used for each piece.

3.4 INSTALLATION OF INSULATION

Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. For thermal insulation the actual installed thickness shall provide the thermal resistance (R-values) shown. For acoustical insulation the installed thickness shall be as shown. Insulation shall

be installed on the weather side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

3.5 INSTALLATION OF VAPOR RETARDER

Vapor retarder shall be applied to provide a continuous barrier at window and door frames, and at all penetrations such as electrical outlets and switches, plumbing connections, and utility service penetrations. Joints in the vapor retarder shall be lapped and sealed according to the manufacturer's recommendations.

3.6 INSTALLATION OF AIR INFILTRATION BARRIER

Air infiltration barrier shall be installed in accordance with the manufacturer's recommendations.

3.7 INSTALLATION OF TIMBER CONNECTORS

Installation of timber connectors shall conform to applicable requirementsof AFPA-T901.

TABLE I. SPECIES AND GRADE

Subflooring, Wall Sheathing, Furring

Grading Rules	Species	Const Standard	No. 2 Comm	No. 2 Board Comm	No. 3 Comm
NELMA-01					
	Northern White Cedar				X
	Eastern White Pine	X			
	Northern Pine	X			
	Balsam Fir				X
	Eastern Hemlock-Tamarack				X
SPIB-1001					
	Southern Pine		X		
WCLIB Std 17					
	Douglas Fir-Larch	X			
	Hem-Fir	X			
	Sitka Spruce	X			
	Mountain Hemlock		X		
WWPA-01					
	Douglas Fir-Larch	X			
	Hem-Fir	X			
	Idaho White Pine	X			
	Lodgepole Pine			X	
	Ponderosa Pine			X	
	Sugar Pine			X	
	Englemann Spruce			X	
	Douglas Fir South			X	
	Mountain Hemlock			X	
	Subalpine Fir				X

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 06100
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT NO. a.	TRANSMITTA NO. b.	ITE NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REVIEWER r.	SUBMI s.	APPROV NEEDED BY t.	MATER NEEDE BY u.	CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Structural wood members; GA.										
			SD-04 Drawings										
		2	Structural wood members; GA.										
			SD-13 Certificates										
		3	Grading and Marking; FIO.										

ENG FORM 4288-R, (ORL), JAN 97 EDITION OF MAR 95 IS OBSOLETE

SECTION 06200

FINISH CARPENTRY
09/9

PART 1 GENERAL 06200-1
1.1 REFERENCES 06200-1
1.2 SUBMITTALS 06200-2
1.3 DELIVERY AND STORAGE 06200-2

PART 2 PRODUCTS 06200-2
2.1 WOOD ITEMS, SIDING, AND TRIM 06200-2
2.2 NAILS 06200-4
2.3 SOLID SURFACE WINDOW SILLS 06200-4

PART 3 EXECUTION 06200-4
3.1 NOT USED 06200-4
3.3 WOODWORK ITEMS 06200-4
3.4 SOLID SURFACE SILL MATERIAL 06200-4
3.5 VINYL SOFFITS 06200-5
3.6 FASCIAS AND EXTERIOR TRIM 06200-5
3.4 MOLDING AND INTERIOR TRIM 06200-5

SAFETY PAYS

SECTION 06200

FINISH CARPENTRY
09/96

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1435 (1994) Outdoor Weathering of Plastics

ASTM F 547 (1977; R 1990) Definition of Terms Relating to Nails for One Use with Wood and Wood-Base materials

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C9 (1995) Plywood - Preservative Treatment by Pressure Processes

AWPA M4 (1995) Standard for the Care and Preservative-Treated Wood Products

AWPA P5 (1996) Standards for Waterborne Preservatives

CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA-01 (1995) Standard Specifications for Grades of California Redwood Lumber

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA-01 (1993) Standard Grading Rules for Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURER'S ASSOCIATION (SCMA)

SCMA-01 (1986; Supple No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB-1001 (1994) Standard Grading Rules for Southern Pine Lumber

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17 (1993) Grading Rules for West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01 (1995; Supple Nos. 1-3) Western Lumber Grading Rules 95

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)

WMMPA WM 6 (1987) Industry Standard for Non-Pressure Treating of Wood Millwork

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Finish Carpentry; GA.

Drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

SD-14 Samples

Moldings; FIO.

Fascias and Trim; FIO.

Vinyl Soffits; FIO.

Samples shall be of sufficient size to show patterns, color ranges, and types, as applicable, of the material proposed to be used.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 WOOD ITEMS, SIDING, AND TRIM

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the

inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Moisture Content

The maximum moisture content of untreated trim and wood siding shall be 15 percent at the time of delivery to the jobsite and when installed. Moisture content of all other material shall be in accordance with the standard under which the product is produced.

2.1.4 Preservative Treatment

2.1.4.1 Plywood

Plywood shall be treated in accordance with AWPA C9 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

a. 4 kg per cubic meter intended for above ground use.

b. 6.4 kg per cubic meter intended for ground contact.

2.1.5 Moldings, Display Rails and Chair Rails

Moldings, display rails and chair rails shall be of the patterns indicated and shall be of a grade compatible with the finish specified.

2.1.6 Woodwork Items

2.1.6.1 Utility Shelving

Utility shelving shall be a suitable species equal to or exceeding 73 requirements of No. 3 Common white fir under WWPA-01, 25 mm thick; or plywood, interior type, Grade A-B, 12.7 mm thick, any species group.

2.1.7 Vinyl Soffit

Vinyl soffits shall be manufactured to withstand outdoor weathering in accordance with ASTM D 1435 and shall meet the physical requirements of ASTM D 3679. Panels shall be solid and shall have smooth surface.

2.1.8 Clothes Hanger Rods

Rods shall be steel , seamless, oval shaped tube, 30 mm by 15 mm by 1mm, nickel plated. Rods shall be supported at each end by suitable nickel plated sockets and by nickel plated intermediate bracket spaced at no more than 900 mm centers.

2.2 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 40 mm into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

2.3 SOLID SURFACE WINDOW SILLS

Solid surface window sills shall be formed of polyester and acrylic resin material with fire retardant fillers and coloring agents. Sills shall be of one piece as size allows. Color and pattern shall be as shown on finish schedules. Fabrication shall be performed by a manufacturer's approved installer/fabricator.

PART 3 EXECUTION

3.1 NOT USED

3.2 MOLDING, DISPLAY RAILS, CHAIR RAILS AND INTERIOR TRIM

Molding, display rails, chair rails and interior trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for 74 attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

3.3 WOODWORK ITEMS

3.3.1 Shelving

Shelving shall be anchored to supporting construction. Unless otherwise indicated, shelves shall be supported by wall-supported brackets not more than 600 mm on center or as required to limit deflection to 6 mm between supports with a load of 525 N per meter. Adjustable shelf hardware shall be steel standards, channel shaped, with 25 mm adjustment slots and brackets designed for attachment to standards.

3.3.2 Clothes Hanger Rods

Rods shall be provided where indicated and in all closets having hook strips. Rods shall be nickel plated steel pipe as indicated. Rods shall be supported at each end by suitable sockets, and by intermediate brackets spaced at not more than 900 mm centers.

3.4 SOLID SURFACE SILL MATERIAL

Install solid surface sills with adhesive products as recommended by the manufacturer. Provide 50 mm wide

reinforcing strip of same material under each joint. Joints shall be supported by framing and specified slip sheet. Edges to be joined shall be shall be straight, smooth and clean. Joints should be made with manufacturer's recommended joint adhesive. Joints shall be inconspicuous in appearance and without voids. All edges shall be sanded smooth. Finish shall be matte and uniform throughout. Install components plumb and level in accordance with approved submittal.

3.5 VINYL SOFFITS

Vinyl soffits shall rest in a "j" channel at each end of the soffit panel. Each panel shall be interlocked at the locking hem and nailed to a support at the nailing flange. Nails shall be placed at the center of the slots on the nailing flange, and loosely nailed to allow movement in the panel.

3.6 FASCIAS AND EXTERIOR TRIM

Exposed surfaces and square edges shall be machine sanded, caulked, and constructed to exclude water. Joints of built-up items, in addition to nailing, shall be glued as necessary for weather-resistant construction. End joints in built-up members shall be well distributed. Joints in flat work shall be shouldered. Backs of wide-faced miters shall be held together with metal rings and glue. Fascias and other flat members shall be in maximum practicable lengths. Cornices shall be braced, blocked, and rigidly anchored for support and protection of vertical joints.

3.7 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish 75 applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

TABLE I. SPECIES AND GRADE TABLES

Grading Rules	Species	Choice	Clear	C Select	C & Better
NELMA-01	Eastern Cedar			X	
	Eastern Hemlock		X		
	Tamarack				X
	Eastern W. Pine				X
	Northern Pine				X
	Eastern Spruce			X	
	Balsam Fir		X		
	Redwood			X	
CRA-RIS-01-SS					
SCMA-01	Cypress			X	
	Southern Pine				X
SPIB-1001					
WCLIB Std 17	Douglas Fir				X
	Larch				X
	Hemlock Fir				X
	Mountain Hemlock				X
	Sitka Spruce				X
WWPA-01	Douglas Fir				X
	Larch				X
	Hemlock Fir		X		
	Mountain Hemlock				X
	Western Larch		X		
	Idaho White Pine	X			
	Lodgepole Pine		X		
	Ponderosa Pine		X		
	Sugar Pine		X		
	Englemann Spruce		X		
	Douglas Fir South		X		
	Subalpine Fir		X		

NOTE 1: Western Cedar under WCLIB Std 17 shall be Grade B; and under WWPA-01, Western Cedar shall be Grade B bevel for siding and Grade A for trim.

NOTE 2: Except as specified in NOTE 3 below, siding and exterior trim shall be any of the species listed above. Interior trim shall be any one of the species listed above and the highest grade of the species for stain or natural finish and one grade below highest grade of species for paint finish.

NOTE 3: Southern Yellow Pine, Douglas Fir, Larch, Western Larch, and Tamarack shall not be used where painting is required and may be used on exterior work only when approved and stained with a preservative type stain.

SAFETY PAYS

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 06200
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-04 Drawings										
			Finish Carpentry; GA.										
			SD-14 Samples										
			Moldings; FIO.										
			Fascias and Trim; FIO.										
			Vinyl Soffit; FIO										

ENG FORM 4288-R, (ORL), JAN 97 EDITION OF MAR 95 IS OBSOLETE

SECTION 06410

06410-CASEWORK

PART 1 GENERAL 06410-1
1.1 REFERENCES 06410-1
1.2 GENERAL REQUIREMENTS 06410-1
1.3 SUBMITTALS 06410-1
1.4 DELIVERY AND STORAGE 06410-2

PART 2 PRODUCTS 06410-2
2.1 BASIC MATERIALS AND FABRICATION METHODS 06410-2
2.2 ARCHITECTURAL CASEWORK 06410-3
2.3 PLASTIC LAMINATE COUNTERTOPS 06410-4
2.4 CABINET HARDWARE AND ACCESSORY MATERIALS 06410-4
2.5 MISCELLANEOUS CABINETS 06410-5
2.6 PREPARATION 06410-5

PART 3 EXECUTION 06410-5
3.1 INSTALLATION 06410-5
3.2 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION 06410-6

SAFETY PAYS

SECTION 06410

CASEWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI-P200 1	(1994; 6th Ed. Version 1) Quality Standards.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A156.9	(1982) Cabinet Hardware
ANSI A161.1	(1985) Recommended Performance & Construction Standards For Kitchen and Vanity Cabinets

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

LD 3	(1995) High-Pressure Decorative Laminates

1.2 GENERAL REQUIREMENTS

1.2.1 Base and Wall Cabinets

Cabinets shall be wood factory-manufactured, factory-finished of the manufacturer's standard sizes and of the type, design, and configuration indicated. Cabinets shall be constructed as specified hereinafter or shall meet the requirements of ANSI A161.1. Evidence of conformance to ANSI A161.1 shall be provided and such evidence shall be the National Kitchen Cabinet Association (NKCA) certification seal or certified copies of NKCA test reports. Tests shall be conducted by independent laboratories approved by NKCA. Both wall and base cabinet assemblies shall consist of individual units joined into continuous sections as indicated. Fastenings shall be accomplished to permit removal and replacement of individual units without affecting the remainder of the installation. Drawers shall be removable and shall be equipped with position stops to avoid accidental complete withdrawals. Shelves shall be fixed or adjustable as indicated.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Fabricated Items; FIO.

Manufacturer's catalog cuts and descriptive material.

SD-04 Drawings

Fabricated Items; GA.

Shop drawings shall indicate materials and details of construction, methods of fastening, complete layout of cabinets and accessories and erection and installation details.

SD-14 Samples

Fabricated Items; GA.

Samples to be submitted for approval with the shop drawings shall include the items listed below. In lieu of individual samples, complete minimum size cabinets may be furnished as samples. Mock-up units are not acceptable. Samples and descriptive data of solid wood, plywood or particle board with factory-applied opaque finish, 304 mm square, for each finish system and color.

a. Counter top and back splash - One section, 101 mm, containing both.

b. Door and drawer front - One of each, with hardware mounted.

c. Laminated plastic color samples, 51 mm by 76 mm.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 BASIC MATERIALS AND FABRICATION METHODS

2.1.1 General

Except as otherwise indicated, comply with following requirements for architectural casework not specifically indicated as prefabricated or prefinished standard products.

2.1.2 Wood Moisture Content

Provide kiln-dried (KD) lumber with an average moisture content range of 6% to 11% for interior work. Maintain temperature and relative humidity during fabrication, storage, and finishing operations so that moisture content values for casework at time of installation do not exceed 8% to 13%.

2.1.3 Interior Wood

2.1.3.1 Solid Wood

Any closed-grain hardwood complying with requirements for specified woodwork grade.

2.1.3.2 Plywood

Any closed-grain hardwood plywood with exterior glue complying with requirements for specified woodwork grade.

2.1.4 Plastic Laminate

Plastic laminate and adhesives shall conform to the requirements of NEMA LD 3. The color, pattern and finish shall be as indicated on finish schedule.

2.1.5 Quality Standards

For following types of architectural wood work; comply with indicated standards as applicable:

Casework and Countertops: AWI Section 400.
Shelving: AWI Section 600
Miscellaneous Work: AWI Section 700.

2.1.6 Pre-Cut Openings

Fabricate architectural casework with pre-cut openings, when possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutoffs and, where located in countertops and similar exposures seal edges of cutouts with a water-resistant coating.

2.1.7 Measurements

Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain measurements and verify dimensions and shop drawing details as required for accurate fit. Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of woodwork for accurate fit.

2.2 ARCHITECTURAL CASEWORK

2.2.1 Plastic Laminate Finished Casework

Casework with plastic laminate finish shall conform to AWI Custom Grade. Construction shall be reveal overlay.

2.2.2 Exposed Surfaces

Provide high pressure laminate in grades indicated for the following types of surfaces:

Horizontal Surfaces: GP-50 (1.2 mm nominal thickness).

Vertical Surfaces: GP-50 (1.2 mm nominal thickness).

2.2.3 Exposed Edges of Casework

Fabricate exposed edges of casework, including edges of doors and drawers when open, with matching plastic laminate, except as otherwise indicated.

2.2.4 Dust Panels

Provide dust panels of 6.4 mm thick plywood or tempered hardboard above compartments and drawers, except where located directly below countertops.

2.3 PLASTIC LAMINATE COUNTERTOPS

2.3.1 General

Countertop and backsplash shall be constructed of 19.1 mm plywood or particle board core and shall be cove type comprised of a single unit with self-edging and plastic laminate coved at the juncture of the countertop and backsplash or fully formed type comprised of a single unit with shaped edges using wood nose molding at counter edge and coved wood molding or shaped wood block at juncture of the countertop as indicated. Backsplash shall be not less than 88.9 mm high. Edging and trim shall consist of plastic laminate cut and fitted to all exposed edges. End splashes constructed of 19.1 mm plywood or particle board core shall be supplied. Counters shall be provided with watertight sink rim.

2.3.2 Plastic Laminates

Continuous sheets of longest lengths practicable shall be provided. Joints in surface sheeting shall be tight and flush and held to a practicable minimum. When the countertop and backsplash are two separate units, GP 50 plastic laminate shall be used. When the countertop and backsplash are one unit, PF 42 plastic laminate shall be used. Plastic laminate and adhesive shall conform to the requirements of NEMA LD 3. For fully formed and cove type countertops, the post-forming plastic laminate shall not be bent to a radius smaller than the limit recommended by the plastic manufacturer. Design, color, and finish shall be as specified in the finish schedule.

2.3.3 Sink Rims

Sink rims shall be of the corrosion resistant steel clamping type, sized to the sink, and a standard product of a manufacturer regularly producing this type of equipment.

2.3.4 Backer Sheets

Backer sheets of high pressure plastic laminate, Grade BK 20 shall be applied to the underside of all core materials.

2.4 CABINET HARDWARE AND ACCESSORY MATERIALS

2.4.1 General

Provide cabinet hardware and accessory materials associated with architectural woodwork, except for units which are specified as "door hardware" in other sections of these specifications.

2.4.2 Hardware Standards

Except as otherwise indicated, comply with ANSI A 156.9 "American National Standard for Cabinet Hardware".

2.4.2.1 Quality Level

Type 2 (institutional), unless otherwise indicated.

2.4.2.2 Quality Certification

Where available, provide cabinet hardware bearing the BHMA certification label, affixed either to hardware or its packaging, showing compliance with BHMA Cabinet Hardware Standard 201.

2.4.3 Cabinet Door Hardware

Provide hinges, catches and pulls of types required, to accommodate each door size and style.

2.4.4 Drawer Hardware

Provide slides and pulls of types required to accommodate each drawer size and style. Equip each drawer with side-mounted, full-extension, ball-bearing, nylon roller drawer slides with load capacity of 34 kg per pair.

2.4.5 Locks

Where indicated, provide standard pin-type or disc-type (5 pins or discs) tumbler locks, keyed individually except as otherwise indicated.

2.4.6 Shelf Supports

Where shelving is indicated as "adjustable", provide slotted-type standards and brackets of type needed to support shelves with uniform 194 kg per sq. m loading.

2.4.7 Exposed Hardware Finish

Except where not available, provide exposed hardware with BHMA Code 626 satin 63 chromium plate finish (US26D); where not available, provide either satin aluminum or satin stainless steel finish.

2.5 MISCELLANEOUS CABINETS

Miscellaneous cabinets, including vanities shall be furnished as indicated and shall be of the same materials and construction as the casework cabinets.

2.6 PREPARATION

2.6.1 Condition casework to average prevailing humidity conditions in installation areas prior to installing.

PART 3 EXECUTION

3.1 INSTALLATION

Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 3.2 mm in 228.6 mm 64 for plumb and level (including countertops); and with 1.6 mm maximum offset in flush adjoining surface, 3.2 mm maximum offsets in revealed adjoining surfaces. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

3.1.1 Anchorage

Anchor casework to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with casework, and matching final finish where transparent finish is indicated.

3.1.2 Casework

Install without distortion so that doors and drawers will fit openings properly and be accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of casework with transparent finish.

3.1.3 Countertops

Anchor securely to base units and other support systems as indicated. The inner edge of sink cut-outs for laminated plastic tops shall be painted with a coat of semi-gloss enamel paint and sink flanges shall be set in bed of sealant. Case work manufacturer to coordinate size of sink cutouts with plumbing contractor.

3.1.4 Wood Storage Shelving

Complete the assembly of units and install in the areas indicated, including hardware and accessories as indicated.

3.2 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

Repair damaged and defective casework wherever possible to eliminate defects 65 functionally and visually; where not possible to repair properly, replace casework. Adjust joinery for uniform appearance. Clean hardware, lubricate and make final adjustments for proper operation. Clean casework on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas. Complete the finishing work specified as work of this section, to whatever extent not completed at shop or prior to installation of casework.

3.2.1 Protection

Protect architectural casework during remainder of construction period to ensure that work will be without damage or deterioration at time of acceptance.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 06410
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO.	TRANS-MITTAL NO.	ITEM NO.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER	REV-IEW-ER	SUBMIT	APPROV. NEEDED BY	MATER. NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
a.	b.	c.	d. through q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
			PAR. NO. SD-01 Data										
			Fabricated Items; FIO.										
			SD-04 Drawings										
			Fabricated Items; GA.										
			SD-14 Samples										
			Fabricated Items; GA.										

SAFETY PAYS

SECTION 07112

BITUMINOUS WATERPROOFING
12/93

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1.2 SUBMITTALS 07112-1
1.3 QUALIFICATIONS 07112-2
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PART 2 PRODUCTS 07112-2
2.1 ASPHALT WATERPROOFING 07112-2
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3.1 SURFACE PREPARATION 07112-3
3.2 HOT-APPLIED ASPHALT WATERPROOFING 07112-3
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3.4 PROTECTION OF COMPLETED WORK 07112-4

*** SAFETY PAYS ***

SECTION 07112

BITUMINOUS WATERPROOFING
12/93

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 208	(1994) Cellulosic Fiber Insulating Board
ASTM D 41	(1985) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 173	(1986) Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing
ASTM D 449	(1989) Asphalt Used in Dampproofing and Waterproofing
ASTM D 1327	(1986) Bitumen-Saturated Woven Burlap Fabrics Used in Roofing and Waterproofing
ASTM D 1668	(1986) Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
ASTM D 4586	(1993) Asphalt Roof Cement, Asbestos Free

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section C-01300 SUBMITTAL PROCEDURES:

SD-01 Data

Reinforcing Fabric; GA.

Protection Board; GA.

Manufacturer's data including technical information which indicates full compliance with this section.

SD-06 Instructions

Application; FIO.

Manufacturer's installation instructions, before delivery of materials to the site. Instructions shall specify acceptable range of asphalt application temperatures and the maximum temperature for holding asphalt in a heated condition.

SD-13 Certificates

Materials; FIO.

Certificates from manufacturer attesting that asphalt manufactured and shipped to jobsite meets the specified requirements.

1.3 QUALIFICATIONS

Work shall be performed by skilled laborers thoroughly experienced in the type of bituminous waterproofing work specified to meet the requirements of the contract.

1.4 DELIVERY, STORAGE AND HANDLING

Waterproofing materials shall be delivered to the project site in the original sealed containers bearing the name of the manufacturer, contents and brand name. Asphalt shall be protected from freezing in a weathertight enclosure. Reinforcement fabrics shall be protected from moisture damage and moisture absorption in a weathertight enclosure or shall be stored off the ground on pallets, and covered on top and all sides with breathable-type canvas tarpaulins. Plastic sheets cause condensation buildup and therefore shall not be used to cover waterproofing materials. Damaged or deteriorated materials shall be removed from project site.

PART 2 PRODUCTS

2.1 ASPHALT WATERPROOFING

2.1.1 Primer

Primer for hot-applied asphalt waterproofing shall conform to ASTM D 41, asbestos-free, non-fibrated, manufactured with highly ductile soft asphalts and selected hydrocarbons.

2.1.2 Above-Grade Hot-Applied Asphalt

For above-grade applications where asphalt will not be exposed to temperatures exceeding 50 degrees C, hot-applied asphalt for membrane waterproofing system shall conform to ASTM D 449, Type II. For above-grade applications where asphalt will be exposed to sunlight and temperatures exceeding 50 degrees C, hot-applied asphalt shall conform to ASTM D 449, Type III.

2.1.3 Below-Grade Hot-Applied Asphalt

Hot-applied asphalt for below-grade applications shall conform to ASTM D 449, Type I, asbestos-free, manufactured from crude petroleum, suitable for use with membrane waterproofing systems.

2.1.4 Reinforcement Fabrics

2.1.4.1 Cotton Fabrics

Cotton fabrics shall be woven entirely of cotton conforming with ASTM D 173, thoroughly and uniformly saturated with asphalt.

2.1.4.2 Woven Burlap Fabrics

Woven burlap fabrics shall be composed of 100 percent jute fiber and two cotton threads at each selvage conforming with ASTM D 1327, thoroughly and uniformly saturated with asphalt. The fabric mesh shall not be completely closed or sealed by the process of saturation. Sufficient porosity shall be maintained to allow successive moppings of the plying asphalt to seep through. The surface shall not be coated or covered with talc or any other

substances that will interfere with the adhesion between fabric and plying asphalt. The fabric surface shall be uniformly smooth and free of irregularities, folds and knots. The finished woven burlap fabrics shall be free of ragged edges, untrue edges, breaks or cracks, and other visible external defects.

2.1.4.3 Glass Fabrics

Glass fabrics shall conform to ASTM D 1668 Type I, asphalt-treated woven glass waterproofing fabrics coated with asphalt.

2.1.5 Flashing Cement

Flashing cement shall conform to ASTM D 4586, Type I, trowel grade, asbestos free, manufactured from asphalts characterized as adhesive, healing and ductile.

2.2 INSULATION BOARDS

Insulation boards shall conform to ASTM C 208 cellulosic fiber boards, construction grade, 13 mm thick, fibrous-felted homogeneous panel. Insulation boards shall be manufactured from ligno-cellulosic fibers (wood or cane) by a felting or molding process, asphalt-saturated or coated, with a density of 49 to 151 kg per square meter. Surfaces of insulation boards shall be free of cracks, lumps, excessive departure from planeness, or other defects that adversely affect performance.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces scheduled for bituminous waterproofing shall be prepared in accordance with waterproofing manufacturer's recommendations. Surface preparation shall be approved prior to waterproofing application.

3.1.1 Protection of Surrounding Areas

Before starting the waterproofing work, the surrounding areas and surfaces shall be protected from spillage and migration of asphalt onto other work. Drains and conductors shall be protected from clogging with asphalt.

3.1.2 Masonry Surfaces

Surfaces shall be free of oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Mortar joints shall be flush and free of extraneous mortar and chipped or broken masonry.

3.1.3 Concrete Surfaces

Surfaces shall be properly cured, free of form release agents, oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Form ties shall be cut flush with surface. Sharp protrusions and form match lines shall be removed. Holes, voids, spalled areas and cracks which can damage waterproofing materials shall be repaired. Rough surfaces shall be parged with a well-adhering coat of cement mortar.

3.1.4 Metal Surfaces

Surfaces shall be dry and be free of rust, scale, loose paint, oil, grease, dirt, frost and debris.

3.2 HOT-APPLIED ASPHALT WATERPROOFING

Asphalt waterproofing shall be applied when the ambient temperature is 4 degrees C or above. Heating kettles and tanks shall be provided with automatic thermostatic control capable of maintaining asphalt temperature. Controls shall be calibrated and maintained in working order for duration of work. At time of application, asphalt

shall not be heated above the equiviscous temperature (EVT) recommended by manufacturer. Immediately before use, temperature shall be measured with a portable thermometer at the point of application. EVT and flashpoint temperatures of asphalt in kettle shall be conspicuously posted on kettle. Asphalt with a temperature not conforming to the manufacturer's recommendations shall be returned to the kettle. Asphalt overheated by more than 10 degrees C for more than 1 hour shall be removed from site.

3.2.1 Below-Grade Wall Waterproofing

Waterproofing for foundation walls shall consist of a 3-ply hot-applied asphalt membrane system. Fabrics shall be installed using the "shingle" method. Joints shall be caulked prior to primer applications. Primer shall be applied at a rate of 0.2 liters per square meter. Fabrics shall be overlapped at ends and staggered a minimum 610 mm for 3-ply system. End-to-end taping is not acceptable. Each fabric shall be firmly embedded into a solid uniform coating of hot asphalt at a rate of 0.98 kg per square meter by pressing with broom. Fabrics shall not touch fabrics. Hot asphalt shall penetrate each fabric to provide the required adhesion. Asphalt between fabrics shall not be excessive to prevent slippage. Waterproofing system consisting of two or more fabrics shall be provided with fabric reinforcement at corners, angles, over construction joints, and in locations where waterproofing fabrics are subject to unusual stress.

3.3 CLEAN-UP

Surfaces of other work which are stained with waterproofing materials shall be cleaned with a cleaner recommended by waterproofing manufacturer.

3.4 PROTECTION OF COMPLETED WORK

3.4.2 Wall Waterproofing

Waterproofing against which backfill is to be placed shall be protected with a single layer of insulation board. Insulation boards shall be pressed into the final mopping while the asphalt is still hot, with edges of boards placed into moderate contact and joints staggered. For two-layer installation, joints in second layer shall be staggered over joints in first layer. Where surfaced insulation board is used, the surfaced side shall face outward. Boards shall be carefully and neatly fitted around projections, and shall cover the entire surface of the waterproofing materials. Waterproofing system not covered with protection boards shall be protected to prevent damage from subsequent building operations. Installed boards shall not remain exposed at the end of a work day.

--End of Section--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 07112
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. SD-01 Data										
		1	Reinforcing Fabric; GA.										
		2	Protection Board; GA.										
			SD-06 Instructions										
		3	Application; FIO.										
			SD-13 Certificates										
		4	Materials; FIO.										

***** SAFETY PAYS *****

SECTION 07160

BITUMINOUS DAMPPROOFING
12/93

PART 1 GENERAL 07160-1
1.1 REFERENCES 07160-1
1.2 SUBMITTALS 07160-1
1.3 QUALIFICATIONS 07160-1
1.4 DELIVERY, STORAGE AND HANDLING 07160-1

PART 2 PRODUCTS 07160-2
2.1 EMULSION-BASED ASPHALT DAMPPROOFING 07160-2
2.2 SOLVENT-BASED ASPHALT DAMPPROOFING 07160-2

PART 3 EXECUTION 07160-2
3.1 SURFACE PREPARATION 07160-2
3.2 APPLICATION OF BITUMINOUS DAMPPROOFING 07160-3
3.3 CLEAN-UP 07160-3
3.4 PROTECTION 07160-3

SAFETY PAYS

SECTION 07160

BITUMINOUS DAMPPROOFING
12/93

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 41	(1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 1187	(1995) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM D 1227	(1987) Emulsified Asphalt Used as a Protective Coating for Roofing
ASTM D 4479	(1993) Asphalt Roof Coatings - Asbestos Free

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Materials; FIO.

Certificates attesting that the materials meet the requirements specified.

1.3 QUALIFICATIONS

Work shall be performed by skilled laborers thoroughly experienced in the type of bituminous dampproofing work specified to meet the requirements of the contract.

1.4 DELIVERY, STORAGE AND HANDLING

Dampproofing materials shall be delivered to the project site in the original sealed containers bearing the name of manufacturer, contents and brand name, and stored in a weathertight enclosure to prevent moisture damage and absorption. Dampproofing materials shall be protected from freezing. Asphalt shall be stored off the ground on pallets, and covered on top and all sides with breathable-type canvas tarpaulins. Plastic sheets cause condensation buildup and therefore shall not be used to cover dampproofing materials. Care shall be taken during storage to

avoid separation or settlement of the emulsion components. Damaged or deteriorated materials shall be removed from the project site.

PART 2 PRODUCTS

2.1 EMULSION-BASED ASPHALT DAMPPROOFING

2.1.1 Fibrated Emulsion-Based Asphalt

Fibrated emulsion-based asphalt dampproofing shall be cold-applied type conforming to ASTM D 1227 Type IV, asbestos-free, manufactured of refined asphalt, emulsifiers and selected clay, fibrated with mineral fibers and shall be compatible with the cavity wall insulation. For spray or brush application, emulsion shall contain a minimum of 59 percent solids by weight, 56 percent solids by volume. For trowel application, emulsion shall contain a minimum of 58 percent solids by weight, 55 percent solids by volume.

2.1.2 Non-Fibrated Emulsion-Based Asphalt

Non-fibrated emulsion-based asphalt dampproofing shall be cold-applied type conforming to ASTM D 1187 Type II or ASTM D 1227 Type III, manufactured of refined asphalt, emulsifiers and selected clay and shall be compatible with the cavity wall insulation. Asphalt shall contain a minimum 58 percent solids by weight, 55 percent solids by volume.

2.2 SOLVENT-BASED ASPHALT DAMPPROOFING

2.2.1 Asphaltic Primer

Primer for cold-applied solvent-based asphalt dampproofing shall conform to ASTM D 41, asbestos-free, non-fibrated, manufactured with highly ductile soft asphalts and selected hydrocarbons and shall be compatible with the cavity wall insulation.

2.2.2 Fibrated Asphalt

Fibrated solvent-based asphalt dampproofing shall be cold-applied type conforming to ASTM D 4479 Type I, asbestos-free, manufactured with selected asphalts, stabilizers, mineral spirits and fibrated with mineral fibers and shall be compatible with the cavity wall insulation.. Solvent-based asphalt shall contain 72 percent solids by weight, 65 percent solids by volume.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces indicated to receive bituminous dampproofing shall be prepared in accordance with dampproofing manufacturer's recommendations. Surface preparation shall be approved prior to dampproofing application.

3.1.1 Protection of Surrounding Areas

Before starting the dampproofing work, the surrounding areas and surfaces shall be protected from spillage and migration of asphalt onto other work. Drains and conductors shall be protected from clogging with asphalt.

3.1.2 Masonry Surfaces

Surfaces shall be free of oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Mortar joints shall be flush and free of extraneous mortar and chipped or broken masonry.

3.1.3 Concrete Surfaces

Surfaces shall be properly cured, free of form release agents, oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Form ties shall be cut flush with surface. Sharp protrusions and form match lines shall be removed. Holes, voids, spalled areas and cracks which can damage the dampproofing materials and impair performance shall be repaired. Rough surfaces shall be parged with a well-adhering coat of cement mortar.

3.2 APPLICATION OF BITUMINOUS DAMPPROOFING

3.2.1 Emulsion-Based Asphalt

Emulsion-based asphalt dampproofing work shall not be performed in temperatures below 4 degrees C. Emulsions shall have a smooth and uniform consistency at time of application. Dampproofing materials shall be applied in accordance with manufacturer's published instructions to produce a smooth uniform dry film of not less than 0.3 mm thick without voids or defects. Dull or porous spots shall be recoated. Dampproofing materials shall seal tightly around pipes and other items projecting through dampproofing. Rates of application shall be as follows:

a. Primer: 0.2 liters per square meter, cold-applied.

b. Fibrated Dampproofing: 0.8 liters per square meter, cold-applied with spray, brush or trowel.

c. Non-fibrated Dampproofing: 0.8 liters per square meter, cold-applied with spray, brush or trowel.

3.2.2 Solvent-Based Asphalt

Solvent-based asphalt dampproofing work shall not be performed in temperatures below 4 degrees C. Dampproofing materials shall be applied in accordance with manufacturer's published instructions to produce a smooth uniform dry film not less than 0.3 mm thick without voids or defects. Dull or porous spots shall be recoated. Dampproofing materials shall seal tightly around pipes and other items projecting through dampproofing. Rates of application shall be as follows:

a. Primer: 0.4 liters per square meter, cold-applied.

b. Dampproofing Coat: 0.8 liters per square meter, cold-applied with spray, brush or trowel.

3.3 CLEAN-UP

Surfaces of other work which are stained with dampproofing materials shall be cleaned with a cleaner recommended by dampproofing manufacturer.

3.4 PROTECTION

The completed dampproofing work shall be protected from damage during and after construction.

SAFETY PAYS

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 01330
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. SD-13 Certificates										
			Materials; FIO.										

SAFETY PAYS

SAFETY PAYS

SECTION 07212

FIBER BLANKET INSULATION

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1.2 SUBMITTALS 07212-2
1.3 DELIVERY, STORAGE AND HANDLING 07212-3
1.4 SAFETY PRECAUTIONS 07212-3

PART 2 PRODUCTS 07212-3
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2.6 ACCESSORIES 07212-4
2.7 SOUND ATTENUATION BLANKETS 07212-4

PART 3 EXECUTION 07212-4
3.1 EXISTING CONDITIONS 07212-4
3.2 PREPARATION 07212-5
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SECTION 07212

FIBER BLANKET INSULATION
03/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 518	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties By Means of the Heat Flow Meter Apparatus
ASTM C 665	(1995) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 930	(1992) Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D 828	(1993) Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus
ASTM D 3833M	(1996) Water Vapor Transmission of Pressure-Sensitive Tapes (Metric)
ASTM D 4397	(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E 84	(1997; Rev. A) Surface Burning Characteristics of Building Materials
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM E 136	(1996; Rev. A) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.134	Respiratory Protection

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	(1997) Installation of Oil Burning Equipment
NFPA 54	(1996) National Fuel Gas Code
NFPA 70	(1996) National Electrical Code
NFPA 211	(1996) Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T803 OM	(1988) Puncture Test for Containerboard

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.2.1 SD-02, Manufacturer's Catalog Data

a. Blanket insulation; FIO.

b. Sill sealer insulation; FIO.

c. Blocking; FIO.

d. Pressure sensitive tape; FIO

e. Accessories; FIO.

f. Sound Attenuation; FIO.

1.2.2 SD-06, Instructions

a. Blanket Insulation; FIO.

b. Sound Attenuation; FIO.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.3.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.4 SAFETY PRECAUTIONS

1.4.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

1.4.2 Smoking

Do not smoke during installation of blanket thermal insulation.

1.4.3 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C 930.

PART 2 PRODUCTS

2.1 BLANKET INSULATION

ASTM C 665, Type I, blankets without membrane coverings and a flame spread rating of 25 or less and a smoke developed rating of 150 or less when tested in accordance with ASTM E 84.

2.1.1 Thermal Resistance Value (R-VALUE)

Insulation thickness shall be as shown on the drawings. Insulation shall contain the highest practicable percentage of recovered material which has been recovered or diverted from solid waste, but not including material reused in a manufacturing process. Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided. Identification shall be on individual pieces or individual packages. Materials containing more than one percent asbestos will not be allowed.

2.2 SILL SEALER INSULATION

Mineral wool, 25 mm thick and compressible to 0.8 mm , width of sill, designed to perform as an air, dirt, and insect seal in conformance with ASTM C 665, Type I.

2.3 BLOCKING

Wood, metal, unfaced fiber blankets in accordance with ASTM C 665, Type I, or other approved materials. Use only non-combustible materials meeting the requirements of ASTM E 136 for blocking around chimneys and heat producing devices.

2.4 Not Used

2.5 PRESSURE SENSITIVE TAPE

As recommended by the vapor retarder manufacturer and having a water vapor permeance rating of 5.72 x 10-8 g/Pa.s.m2 (one perm) or less when tested in accordance with ASTM D 3833M.

2.6 ACCESSORIES

2.6.1 Adhesive

As recommended by the insulation manufacturer.

2.6.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

2.6.3 Not Used

2.7 Sound Attenuation Blankets

Mineral fiber blanket (semi-rigid), ASTM C 553, Type III, Class F-2, plain faced.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Before installing insulation, ensure that areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify Contracting Officer of such conditions.

3.2 PREPARATION

3.2.1 Blocking at Access Doors

Prior to installation of insulation, install permanent blocking to prevent insulation from slipping over, clogging, or restricting air flow through equipment or controls that require maintenance or adjustment.

3.2.2 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 75 mm from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 600 mm above fixture.

b. Masonry chimneys or masonry enclosing a flue: 50 mm from outside face of masonry. Masonry chimneys for medium and high heat operating appliances: Minimum clearances required by NFPA 211.

c. Vents and vent connectors used for venting the products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.

d. Gas Fired Appliances: Clearances as required in NFPA 54.

e. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking around flues and chimneys is not required when insulation blanket, including any attached vapor retarder, passed ASTM E 136, in addition to meeting all other requirements stipulated in Part 2. Blocking is also not required if the chimneys are certified by the manufacturer for use in contact with insulating materials.

3.3 INSTALLATION

3.3.1 Blanket Insulation

Install and handle insulation in accordance with manufacturer's Instructions. Keep material dry and free of extraneous materials. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices.

3.3.1.1 Electrical wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.3.1.2 Continuity of Insulation

Install blanket insulation to butt tightly against adjoining blankets and to studs, rafters, joists, sill plates, headers and any obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

3.3.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

3.3.1.4 Cold Climate Requirement

Place insulation to the outside of pipes.

3.3.1.5 Not Used

3.3.1.6 Insulation without Affixed Vapor Retarder

Provide snug friction fit to hold insulation in place. Stuff pieces of insulation into cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers.

3.3.1.7 Sizing of Blankets

Provide only full width blankets when insulating between trusses, joists, or studs. Size width of blankets for a snug fit where trusses, joists or studs are irregularly spaced.

3.3.1.8 Special Requirements for Ceilings

Place insulation under electrical wiring occurring across joists. Pack insulation into narrowly spaced framing.

3.3.1.9 Installation of Sill Sealer

Size sill sealer insulation and place insulation over top of concrete perimeter walls or concrete perimeter floor slab on grade. Fasten sill plate over insulation.

3.3.1.10 Not Used

3.3.1.11 Access Panels and Doors

Affix blanket insulation to access panels greater than 929 square cm and access doors in insulated floors and ceilings. Use insulation with same R-Value as that for floor or ceiling.

3.3.1.12 Sound Attenuation Blankets

For acoustical insulation the installed thickness shall be as shown. Insulation shall be installed on the weather side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

-- End of Section --

SAFETY PAYS

SAFETY PAYS

SECTION 07214

BOARD AND BLOCK INSULATION
3/97

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SECTION 07214

BOARD AND BLOCK INSULATION
03/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 165 (1995) Measuring Compressive Properties of Thermal Insulations

ASTM C 203 (1992) Breaking Load and Flexural Properties of Block-Type Thermal Insulation

ASTM C 272 (1991) Water Absorption of Core Materials for Structural Sandwich Constructions

ASTM C 552 (1991) Cellular Glass Thermal Insulation

ASTM C 553 (1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

ASTM C 578 (1995) Rigid, Cellular Polystyrene Thermal Insulation

ASTM C 591 (1994) Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation

ASTM C 612 (1993) Mineral Fiber Block and Board Thermal Insulation

ASTM C 930 (1992) Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories

ASTM C 1013 (1994) Membrane-Faced Rigid Cellular Polyurethane Roof Insulation

ASTM C 1013 (1995) Flexible, Low Permeance Vapor Retarders for Thermal Insulation

ASTM C 1136 (1995) Flexible, Low Permeance Vapor Retarders for Thermal Insulation

ASTM C 1289 (1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

ASTM D 828 (1993) Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus

ASTM D 1621 (1994) Compressive Properties of Rigid Cellular Plastics

ASTM D 3833M (1996) Water Vapor Transmission of Pressure-Sensitive Tapes (Metric)

ASTM D 4397 (1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

ASTM E 84 (1997; Rev. A) Surface Burning Characteristics of Building Materials

ASTM E 96 (1995) Water Vapor Transmission of Materials

ASTM E 136 (1996; Rev. A) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C

ASTM E 154 (1988; R 1993) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.134 Respiratory Protection

FEDERAL SPECIFICATIONS (FS)

FS HH-I-1972/1 Insulation Board, Thermal, Polyurethane or Polyisocyanurate, Faced with Aluminum Foil on Both Sides of the Foam

FS HH-I-1972/2 Insulation Board, Thermal, Polyurethane or Polyisocyanurate Faced with Asphalt/Organic Felt, Polymer/Organic Mat, Asphalt/Glass Mat or Polymer/Glass Mat on Both Sides of the Foam

FS HH-I-1972/3 Insulation Board, Thermal, Polyurethane or Polyisocyanurate Faced with Perlite Insulation Board on One Side and Asphalt/Organic Felt or Asphalt/Glass Fiber Felt on Other Side of the Foam

FS HH-I-1972/4 Insulation Board, Thermal, Polyurethane or Polyisocyanurate Faced with Gypsum Board on One Side and Aluminum Foil or Asphalt/Organic Felt on the Other Side of the Foam

FS HH-I-1972/5 Insulation Board, Thermal, Polyurethane or Polyisocyanurate Faced with Perlite Board on Both Sides of the Foam

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	(1997) Installation of Oil Burning Equipment
NFPA 54	(1996) National Fuel Gas Code
NFPA 70	(1996) National Electrical Code
NFPA 211	(1996) Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T803 OM	(1988) Puncture Test for Containerboard

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.2.1 SD-02, Manufacturer's Catalog Data

a. Block or board insulation; FIO.

b. Pressure sensitive tape; FIO.

c. Protection board or coating; FIO.

d. Accessories; FIO.

1.2.2 SD-06, Instructions

a. Block or Board Insulation; FIO.

b. Adhesive; FIO.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Deliver materials to the site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.3.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.4 SAFETY PRECAUTIONS

1.4.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.]

1.4.2 Other Safety Considerations

Consider safety concerns and measures as outlined in ASTM C 930.

PART 2 PRODUCTS

2.1 BLOCK OR BOARD INSULATION

Provide only thermal insulating materials recommended by manufacturer for type of application indicated. Provide board or block thermal insulation conforming to the following standards and the physical properties listed below:

a. Polystyrene Board

Polystyrene board shall be extruded and conform to ASTM C 578, Type IV.

b. Polyurethane or Polyisocyanurate Board

Polyurethane or polyisocyanurate board shall conform to ASTM C 1013 (having a minimum recovered material content of 9 percent by weight of core material in the polyurethane or polyisocyanurate portion). Unfaced preformed polyurethane shall conform to ASTM C 591. Faced polyisocyanurate shall conform to ASTM C 1289.

2.1.1 Thermal Resistance

Insulation thickness shall be as shown on the drawings. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages.

2.1.2 Fire Protection Requirement

a. Flame spread index of 100 or less when tested in accordance with ASTM E 84.

b. Smoke developed index of 150 or less when tested in accordance with ASTM E 84.

2.1.3 Other Material Properties

Provide thermal insulating materials with the following properties:

a. Rigid cellular plastics: Compressive Resistance at Yield: Not less than 170 kilopascals (kPa) when measured according to ASTM D 1621.

b. Mineral fiber board: Compressive strength: Minimum load required to produce a reduction in thickness of 10 percent: 120 kg/m2 when tested according to ASTM C 165.

c. Water Vapor Permeance: Not more than 6.3 x 10-8 Pa.s.m2 (1.1 Perms) or less when measured according to ASTM E 96, desiccant method, in the thickness required to provide the specified thermal resistance, including facings, if any.

d. Water Absorption: Not more than 2 percent by total immersion, by volume, when measured according to ASTM C 272.

2.1.4 Not Used

2.1.5 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the material meets all other requirements of this section.

2.1.6 Prohibited Materials

Do not provide materials containing more than one percent of asbestos.

2.1.7 Rigid Masonry Insulation

Masonry rigid board-type cavity wall insulation is specified in Section 04200 "Masonry".

2.1.8 Curtain Wall Insulation

Semi-rigid board with foil reinforced kraft paper vapor retarder with flame spread not to exceed 25 and maximum smoke development of 50.

2.2 Not Used

2.3 PRESSURE SENSITIVE TAPE

As recommended by manufacturer of vapor retarder and having a water vapor permeance rating of 5.72 x 10-8 g/Pa.s.m2 (one perm) or less when tested in accordance with ASTM D 3833M.

2.4 PROTECTION BOARD OR COATING

As recommended by insulation manufacturer.

2.5 ACCESSORIES

2.5.1 Adhesive

As recommended by insulation manufacturer.

2.5.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 Not Used

3.2 PREPARATION

3.2.1 Blocking Around Heat Producing Devices

Unless using insulation board that passes ASTM E 136 in addition to the requirements in Part 2, install non-combustible blocking around heat producing devices to provide the following clearances:

a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: 75 mm from outside face of fixtures and devices or as required by NFPA 70 and,if insulation is to be placed above fixture or device, 600 mm above fixture.

b. Masonry chimneys or masonry enclosing a flue: 50 mm from outside face of masonry. Masonry chimneys for medium and high heat operating appliances: Minimum clearances required by NFPA 211.

c. Vents and vent connectors used for venting products of combustion, flues, and chimneys other than masonry chimneys: minimum clearances as required by NFPA 211.

d. Gas Fired Appliances: Clearances as required in NFPA 54.

e. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking is not required if chimneys or flues are certified by the Manufacturer for use in contact with insulating materials.

3.3 INSTALLATION

3.3.1 Insulation Board

Install and handle insulation in accordance with the manufacturer's Installation Instructions. Keep material dry and free of extraneous materials. Observe safe work practices.

3.3.2 Electrical Wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.3.3 Cold Climate Requirement

Place insulation to the outside of pipes.

3.3.4 Continuity of Insulation

Butt tightly against adjoining boards, studs, rafters, joists, sill plates, headers and obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joint, roof, and floor. Avoid creating any thermal bridges or voids.

3.4 INSTALLATION ON WALLS

3.4.1 Not Used

3.4.2 Not Used

3.4.3 Adhesive Attachment to Concrete

Apply adhesive to wall and completely cover wall with insulation.

a. Full back bed method or

b. Not Used

c. As recommended by the insulation manufacturer.

d. Use only full back method for pieces of 0.1 square meter or less.

e. Butt all edges of insulation and seal edges with tape.

Installer shall not use mechanical fasteners.

3.4.4 Not Used

3.4.5 Protection Board or Coating

Install protection board or coating in accordance with manufacturer's instructions. Install protection over all exterior exposed insulation board and down to 300 mm below grade.

3.5 INSTALLATION ON UNDERSIDE OF CONCRETE FLOOR SLAB

3.5.1 Mechanically Fastened Systems

Size insulation to cover underside of slab. Apply adhesive to slab as recommended by manufacturer. Butt all edges of insulation and seal with tape.

3.5.2 Adhesively Bonded Systems

Apply adhesive to underside of the and completely cover wall with insulation.

a. Full back bed method] or;

b. Spot method: Provide at least six spots having a diameter of approximately 100 mm, located at each corner and mid-point of each of the longer sides.

c. Use full back method for insulation pieces 0.1 square meter or less.

d. Butt all edges of insulation and seal with tape.

3.6 PERIMETER AND UNDER SLAB INSULATION

Install perimeter thermal insulation where heated spaces are adjacent to exterior walls or slab edges in slab-on-grade or floating-slab construction.

3.6.1 Manufacturer's Instructions

Install, attach, tape edges, provide vapor retarder and other requirements such as protection against vermin, insects, damage during construction as recommended in manufacturer's instructions.

3.6.2 Insulation on Vertical Surfaces

Install thermal insulation as indicated. Fasten insulation with adhesive.

3.6.3 Not Used.

3.6.4 Protection of Insulation

Protect insulation on vertical surfaces from damage during construction and back filling by application of protection board or coating. Do not leave installed vertical insulation unprotected overnight. Install protection over entire exposed exterior insulation board. Provide protection extending at least 300 mm below grade.

3.7 Not Used

3.8 Not Used

-- End of Section -

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 07214
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO.	TRANS-MITTAL NO.	ITEM NO.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER	REV-IEW-ER	SUBMIT	APPROV. NEEDED BY	MATER. NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
a.	b.	c.	d. through q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
			PAR. NO. 1.2 SUBMITTALS										
			1.2.1 SD-02, Manufacturer's Catalog Data										
		1	a. Block or board insulation; FIO.										
		2	b. Pressure sensitive tape; FIO.										
		3	c. Protection board or coating; FIO.										
		4	d. Accessories; FIO.										
			1.2.2 SD-06, Instructions										
		5	a. Block or Board Insulation; FIO.										
		6	b. Adhesive; FIO.										

SAFETY PAYS

SECTION 07220

ROOF INSULATION FOR MODIFIED BITUMEN ROOF

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1.4 FIRE CLASSIFICATION 07220-3

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*** SAFETY PAYS ***

SECTION 07220

ROOF INSULATION FOR MODIFIED BITUMEN ROOF

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A208.1	(1993) Particleboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 208	(1995) Cellulosic Fiber Insulating Board
ASTM C 726	(1993) Mineral Fiber Roof Insulation Board
ASTM C 728	(1991) Perlite Thermal Insulation Board
ASTM C 1289	(1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 41	(1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 226	(1994) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 312	(1995) Asphalt Used in Roofing
ASTM D 2178	(1989) Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM D 4586	(1993) Asphalt Roof Cement, Asbestos Free
ASTM D 4897	(1994) Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
ASTM F 547	(1977; R 1990) Terminology of Nails for Use with Wood and Wood-Base Materials

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825	(1995; Supple 1; Supple II; Supple III) Approval Guide

UNDERWRITERS LABORATORIES (UL)

UL-01	(1996) Building Materials Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Application of Insulation; FIO.

Insulation manufacturer's recommendations for the application and installation of insulation.

SD-08 Statements

Inspection; FIO.

The inspection procedure for insulation installation, prior to start of roof insulation work.

SD-13 Certificates

Insulation; FIO. Glass Roofing Felt; FIO.

Certificate attesting that the expanded perlite or polyisocyanurate insulation contains recovered material and showing estimated percent of recovered material. Certificates of compliance for felt materials.

1.3 STORAGE OF MATERIALS

Extruded polystyrene shall be stored in accordance with manufacturer's instructions. Other insulation, base sheet, and felt shall be kept dry at all times, before, during, and after delivery to the site and shall be stored in an enclosed building or in a closed trailer. Wet insulation, wet base sheet or wet felt shall be permanently removed from the site. Felts shall be stacked on end one level high. Felt rolls shall be maintained at a temperature above 10 degrees C for 24 hours immediately before laying.

1.4 FIRE CLASSIFICATION

Insulation shall have been tested as part of a roof construction assembly of the type used in this project and the construction shall be listed as Fire-Classified in UL-01 or Class I in FM P7825.

PART 2 PRODUCTS

2.1 BITUMINOUS MATERIALS

Bituminous materials shall conform to the following requirements:

2.1.1 Asphalt Bitumen

ASTM D 312, Type III or IV. Asphalt flash point, finished blowing temperature, and equiviscous temperature (EVT) shall be indicated on bills of lading or on individual containers.

2.1.2 Asphalt Cement

ASTM D 4586, Type I for horizontal surfaces; Type II for vertical surfaces.

2.1.3 Asphalt Primer

ASTM D 41.

2.2 INSULATION

Insulation shall be a standard product of the manufacturer and shall be factory marked with the manufacturer's name or trade mark, the material specification number, the R-value at 24 degrees C, and the thickness. Minimum thickness shall be as recommended by the manufacturer. Boards shall be marked individually. The thermal resistance of insulation shall be not less than the R-value shown on the drawings. The insulation manufacturing process shall not include chlorofluoro carbons (CFC) or formaldehydes. Insulation and fiberboard shall contain the highest practicable percentage of material which has been recovered or diverted from solid waste (e.g., postconsumer waste), but not including material reused in a manufacturing process. Where two materials have comparable price and performance, the one having the higher recovered material content shall be selected. Insulation shall be one, or a combination of the following materials:

2.2.1 Not Used

2.2.2 Not Used

2.2.3. Not Used

2.2.4 Fiberboard

ASTM C 208 Type II, Grade 1 or 2, roof insulating board with a minimum recovered material content of 80 percent, treated with sizing, wax or bituminous impregnation. Bituminous impregnation shall be limited to 4 percent by weight when used over steel decks.

2.2.5 Mineral-Fiber Insulation Board

ASTM C 726.

2.2.6 Polyisocyanurate

ASTM C 1289, Type I, or ASTM C 1289 Type II, having minimum recovered material content of 9 percent by weight of the polyisocyanurate portion of the board.

2.2.7 NOT USED

2.3 NAILS AND FASTENERS

Nails and fasteners shall conform to the following requirements:

2.3.1 Nails for Fastening Insulation to Flush Mounted Wood Nailers

ASTM F 547 of sufficient length to hold insulation securely in place.

2.3.2 Fasteners

Insulation manufacturer's recommendations except holding power, when driven, shall be not less than 534 N each in steel deck. Fasteners for steel or concrete decks shall conform to FM P7825 for Class I roof deck construction, and shall be spaced to withstand an uplift pressure of 4.3 kPa.

2.3.3 Metal Disks

Flat and not less than 0.39 mm (30 gauge) thickness. Disks used with nails or fasteners for securing fiberboard insulation shall be minimum 25 mm diameter. Disks used with nails or fasteners for securing other board insulation shall be minimum 53 mm in diameter.

2.4 NOT USED

2.5 GLASS ROOFING FELT

ASTM D 2178, Type IV.

2.6 ORGANIC ROOFING FELT

ASTM D 226, Type I.

2.7 WOOD NAILERS

Wood nailers shall conform to Section 06100 ROUGH CARPENTRY including preservative treatment. Edge nailers shall be not less than nominal 150 mm wide and of thickness to finish flush with the top surface of the insulation. Surface mounted nailers shall be a nominal 75 mm wide by the full thickness of the insulation.

PART 3 EXECUTION

3.1 COORDINATION REQUIREMENTS

Insulation and roofing membrane shall be finished in one operation up to the line of termination at the end of each day's work. Completed sections shall be waterproofed when more than one day is required to finish the roofing. Phased construction will not be permitted.

3.2 ENVIRONMENTAL CONDITIONS

Air temperature shall be above 4 Degrees C and there shall be no visible ice, frost, or moisture on the roof deck when the insulation and roofing are installed.

3.3 SUBSTRATE PREPARATION

The substrate construction of any bay or section of the building shall be completed before insulation or vapor retarder work is begun thereon. Vents and other items penetrating the roof shall be secured in position and properly prepared for flashing. Prior to application of vapor retarder or insulation, substrate joints shall be covered with a 100 mm strip of roofing felt, embedded in and coated with asphalt cement. Substrate surface shall be smooth, clean, and dry at time of application.

3.4 HEATING OF ASPHALT

Asphalt shall not be heated higher than 42 degrees C above the EVT or 28 degrees C below the flash point, or 275 degrees C, whichever is lower. EVT and flash point temperatures of asphalt in the kettle shall be conspicuously posted on the kettle. Kettle shall be provided with automatic thermostatic controls and an accurate thermometer. Kettle operators shall be in attendance at all times during heating to ensure that the maximum temperature is not exceeded. Asphalt shall be applied within a range of 14 degrees C below or above the EVT, or as specified by the manufacturer. Application temperature shall be measured at the mop bucket or mechanical applicator. Asphalt at a temperature below this range shall be returned to the kettle. Flame-heated equipment shall not be placed on the roof.

3.5 VAPOR RETARDER

3.5.1 General Application

Vapor retarder shall consist of two plies of roofing felt, mopped at right angle to the slope, with 150 mm end laps staggered at least 300 mm. The full 475 mm starter ply and full 900 mm wide ply sheets shall be placed, in succession, in hot asphalt immediately behind the applicator. Each ply shall be solid mopped in not less than 0.97 nor more than 1.46 kg of asphalt per square meter. A squeegee shall be used with glass felts and a broom shall be used with organic felts to embed the felts, eliminate air pockets and obtain adhesion between the plies. Side and end laps shall be completely sealed. Asphalt shall be visible beyond all edges of each ply as it is being installed. Plies shall be laid free of wrinkles, creases or fishmouths. Workers shall not walk on mopped surfaces when the

asphalt is sticky. For slopes exceeding 42 mm/m, each ply shall be nailed 50 mm and 150 mm from the upper edge with nails spaced 300 mm on centers and staggered in each row.

3.5.2 Edge Requirements

At walls, eaves and rakes, the vapor retarder organic felts shall be extended 225 mm, or separate organic felt plies shall be extended 225 mm, with not less than 225 mm on the substrate, and the extended portion turned back and mopped in over the top of the vapor retarder. At roof penetrations other than walls, eaves and rakes, the vapor retarder or separate plies shall be extended 225 mm to form a lap which shall later be folded back over the edge of the insulation. Asphalt roof cement shall be used under the vapor retarder for at least 225 mm from walls, eaves, rakes and other penetrations.

3.5.3 Not Used

3.5.4 Not Used

3.5.5 Not Used

3.6 INSTALLATION OF WOOD NAILERS

Nailers shall be secured to cast-in-place deck materials by not less than 9 mm diameter anchors embedded in the deck not over 1.2 meters on centers. Nailers shall be secured to precast deck materials and to steel decks as indicated. Bolt anchors shall have nuts and washers countersunk, and bolts shall be cut flush with top of nailer. Powder-actuated fasteners, sized and spaced for nailer anchorage equivalent to that specified and indicated, may be used when approved. Surface mounted nailers shall be installed parallel with the roof slope and shall be spaced not over 1.2 meters face-to-face, except that where the insulation units are less than 1.2 meters in length the nailers shall be spaced to minimize cutting of the insulation.

3.7 APPLICATION OF INSULATION

Insulation shall be laid in two or more layers. Units of insulation shall be laid in courses parallel with the roof slope. End joints shall be staggered. Insulation shall be cut to fit neatly against adjoining surfaces. Joints between insulation boards shall not exceed 6 mm. Joints in successive layers shall be staggered with respect to joints of preceding layer. Where insulation is applied over steel deck, long edge joints shall continuously bear on surfaces of the steel deck. Insulation which can be readily lifted after installation is not considered to be adequately secured. Insulation shall be applied so that all roof insulation applied each day is waterproofed the same day. Phased construction will not be permitted. Application of impermeable faced insulation shall be performed without damage to the facing.

3.7.1 Mechanical Fastening

On steel decks, or any slope exceeding 42 mm/m, the first layer of insulation shall be mechanically fastened. Method of attachment shall be in accordance with recommendations of the insulation manufacturer and requirements specified.

3.7.2 Steel Decks

Uninsulated steel decks shall have insulation applied to span the steel deck flutes and to act as an underlayment for the roof membrane. First layer of insulation on steel deck shall be compatible with mechanical fastening.

3.7.3 Foam Insulation

Polyisocyanurate, or polystyrene foam insulations shall be isolated from built-up roof membrane by a separate or composite layer of cellular glass, mineral fiber board, perlite board, or fiberboard. Polystyrene shall not be exposed to solvent-base adhesive, coal-tar bitumen or to asphalt which is hotter than 93 degrees C.

3.7.4 Installation

Insulation layers shall be laid in solid moppings of hot asphalt applied at a rate of at least 0.97 kg per meter. Asphalt shall not be applied further than one panel length ahead of roof insulation being installed. Where roof slopes are greater than 42 mm/m, roof insulation shall be held in place by both asphalt mopping and mechanical fasteners. Asphalt primer shall be applied at the rate of 0.4 L/square meter over the entire surface to be mopped when the insulation is applied over concrete deck. The edges of insulation boards adjoining vented nailers shall be kept free of asphalt.

3.7.5 Protection Requirements

The insulation shall be kept dry at all times. Insulation boards shall not be kicked into position. Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent. Cutoffs shall be 2 layers of bituminous-saturated felt set in plastic bituminous cement. Cutoffs shall be removed when work is resumed. Edges of insulation at open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, shall be protected until permanent roofing and flashing is applied. Storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces will not be permitted. Smooth, clean board or plank walkways, runways, and platforms shall be used, as necessary to distribute weight to conform to indicated live load limits of roof construction.

3.8 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.

b. Verification of certification, listing or label compliance with FM P7825.

c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.

d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.

e. Inspection of mechanical fasteners; type, number, length, and spacing.

f. Coordination with other materials, cants, sleepers, and nailing strips.

g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.

h. Installation of cutoffs and proper joining of work on subsequent days.

i. Continuation of complete roofing system installation to cover insulation installed same day.

End of Section

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 07220
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT NO. a.	TRANSMITTA NO. b.	ITE NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REVIEWER r.	SUBMI s.	APPROV NEEDED BY t.	MATER NEEDE BY u.	CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-06 Instructions										
		1	Application of Insulation; FIO.										
			SD-08 Statements										
		2	Inspection; FIO.										
			SD-13 Certificates										
		3	Insulation; FIO. Glass Roofing Felt; FIO.										

***** SAFETY PAYS *****

SECTION 07250

SPRAY-APPLIED FIREPROOFING
01/94

PART 1 GENERAL 07250-1
1.1 REFERENCES 07250-1
1.2 SUBMITTALS 07250-2
1.3 DELIVERY AND STORAGE 07250-3
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PART 3 EXECUTION 07250-5
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SAFETY PAYS

SECTION 07250

SPRAY-APPLIED FIREPROOFING
01/94

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84	(1996a) Surface Burning Characteristics of Burning Materials
ASTM E 119	(1995a) Fire Tests of Building Construction Materials
ASTM E 605	(1993) Thickness and Density of Sprayed Fire -Resistive Material (SFRM) Applied to Structural Members
ASTM E 736	(1992) Cohesion/Adhesion of Sprayed Fire -Resistive Materials Applied to Structural Members
ASTM E 759	(1992) Effect of Deflection on Sprayed Fire -Resistive Material Applied to Structural Members
ASTM E 760	(1992) Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members
ASTM E 761	(1992) Compressive Strength of Sprayed Fire -Resistive Material Applied to Structural Members
ASTM E 937	(1993) Corrosion of Steel by Sprayed Fire -Resistive Material (SFRM) Applied to Structural Members
ASTM E 1042	(1992) Acoustically Absorptive Materials Applied by Trowel or Spray
ASTM G 21	(1990) Determining Resistance of Synthetic Polymeric Materials to Fungi

UNDERWRITERS LABORATORIES (UL)

UL-05	(1996; Supple) Fire Resistance Directory (vol 3)
UL 263	(1992) Fire Tests of Building Construction and Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Fireproofing Material; GA.

Data identifying performance characteristics of fireproofing material. Data shall include recommended application requirements and indicate thickness of fireproofing that must be applied to achieve each required fire rating.

SD-09 Reports

Test; GA.

Complete report and test records, attesting that the fireproofing material conforms to the specified requirements. Each test report shall conform to the report requirements specified by the test method.

SD-13 Certificates

Installer Qualifications; GA.

Manufacturer's certification that the installer of the material is licensed or certified by the manufacturer to install the proposed fireproofing as specified for the project. Each person applying the fireproofing shall be certified by the manufacturer of the fireproofing to have received training in application of the proposed materials and in the use of the spray application equipment. The names and copies of training certificates of the individual persons applying the fireproofing shall be included. In addition, the names of at least five projects in which the installer has satisfactorily provided spray applied fireproofing of the type and scope specified herein. The certificate shall include the name and location of the project, description of the type and extent of work, name and phone number of the general contractor and full name of the project site superintendent. The certificate shall include letters of recommendation from the general contractor for at least three of the projects submitted, as evidence of experience.

Surface Acceptability; GA.

Manufacturer's certification that surfaces to be protected have been inspected and are acceptable to receive spray-applied fireproofing. The statement shall list the structural members and the areas that have been inspected and certified.

SD-14 Samples

Spray-Applied Fireproofing; GA.

One sample panel, 450 mm square, for each specified type of fireproofing. Also, a designated sample area of not less than 9 square meters shall be prepared. Sample area shall be representative of typical installation of fireproofing including metal decks, beams, columns and attachments. Equipment, materials and procedures used to apply fireproofing material for the sample area shall be the same as, or representative of that to be used in the work. The sample area shall be approved prior to proceeding with fireproofing work in any other areas. The approved sample area shall be used as a reference standard for thickness and texture throughout application of fireproofing material and shall remain in place and open for observation until all spray-applied fireproofing is approved. After the sample area is completed and accepted it may become part of the work.

1.3 DELIVERY AND STORAGE

Packaged material shall be delivered in the original unopened containers, marked to show the names of the brand and the manufacturer. Fireproofing material shall be kept dry until ready to be used, and shall be stored off the ground, under cover and away from damp surfaces. Damaged or opened containers will be rejected. Material with shelf-life shall be applied prior to expiration of the shelf-life.

1.4 ENVIRONMENTAL CONDITIONS

1.4.1 Temperature

Substrate and ambient air temperatures shall be maintained above 4 degrees C during application and for 24 hours before and after application. Relative humidity shall be maintained within the limits recommended by the fireproofing manufacturer.

1.4.2 Ventilation

Adequate ventilation shall be provided to properly dry the fireproofing after application. In enclosed areas, a minimum of 4 air exchanges per hour shall be provided by forced air circulation.

1.5 INSTALLER QUALIFICATIONS

The installer of the fireproofing material shall have a minimum of 3 years experience in the installation of fireproofing of the type specified. The installer shall be licensed or certified by the manufacturer to install the specified material. Each person applying the fireproofing shall have received training from the manufacturer of the fireproofing material.

1.6 MANUFACTURER'S SERVICES

The manufacturer or his representative shall be onsite prior to, periodically during, and at completion of the application, to provide the specified 76 inspections and certifications; and to ensure that preparations are adequate and that the material is applied according to manufacturer's recommendations and the contract requirements.

1.7 FIRE RESISTANCE RATING

Fire resistance ratings shall be in accordance with the fire rated assemblies listed in UL-05. Proposed materials not listed in UL-05 shall have fire resistance ratings at least equal to the UL-05 ratings as determined by an approved independent testing laboratory based on tests specified in UL 263 or ASTM E 119.

PART 2 PRODUCTS

2.1 SPRAY-APPLIED FIREPROOFING

Spray-applied fireproofing material, including sealer, shall conform to ASTM E 1042, Class (a), Category A, either Type I or Type II, except that the dust removed shall not exceed 0.027 gram per square meter of fireproofing material applied as specified in the project. Material shall be asbestos free, and shall resist fungus for a period of 28 days when tested in accordance with ASTM G 21.

2.1.1 Dry Density and Cohesion/Adhesion

Fireproofing shall have a minimum ASTM E 605 dry density and ASTM E 736 cohesion/adhesion properties as follows:

2.1.1.1 Concealed Structural Components

Fireproofing for structural components concealed above the ceiling, or within a wall, chase, or furred space, shall have a minimum average applied dry density of 240 kg per cubic meter and a cohesion/adhesion strength of 9.57 kPa.

2.1.1.2 Exposed Structural Components

Fireproofing for exposed structural components, except where otherwise specified or indicated, shall have a minimum applied dry density of 350 kg per cubic meter and a cohesion/adhesion strength of 14.36 kPa..

2.1.1.3 Mechanical Rooms

Fireproofing for structural components located in mechanical rooms shall have a minimum applied dry density of 640 kg per cubic meter and a cohesion/adhesion strength of 19.15 kPa.

2.1.2 Deflection

Spray-applied fireproofing shall not crack, spall, or delaminate when tested in accordance with ASTM E 759.

2.1.3 Bond-Impact

Spray-applied fireproofing material shall not crack, spall or delaminate when tested in accordance with ASTM E 760.

2.1.4 Compressive Strength

The minimum compressive strength shall be 48 kPa when tested in accordance with ASTM E 761.

2.1.5 Corrosion

Spray-applied fireproofing material shall not contribute to corrosion of test panels when tested as specified in ASTM E 937.

2.2 SEALER

Sealer shall comply with the recommendations of the firestopping manufacturer. The sealer shall have an acceptable fire hazard classification and shall be green color for easy identification. Coloring shall be approved by the Contracting Officer prior to application to facilitate identification and inspection of sealed areas.

2.3 WATER

Water used for material mixing and surface preparation shall be potable.

2.4 Fire Hazard

Spray-applied fireproofing material and sealer shall have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84. Test sample shall be prepared in accordance with ASTM E 1042 and ASTM E 84 except that painted steel surfaces with the spray applied fireproofing material shall be tested in accordance with ASTM E 119.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces to be fireproofed shall be thoroughly cleaned of dirt, grease, oil, paint, loose rust, rolling lubricant, mill scale or other contaminants that will interfere with the proper bonding of the sprayed fireproofing to the substrate. Overhead areas to be fireproofed shall be cleared of all obstructions interfering with the uniform application of the spray-applied fireproofing. Hardware such as support sleeves, inserts, clips, hanger attachment devices and the like shall be installed prior to the application of the fireproofing. Condition of the surfaces shall be acceptable to the manufacturer prior to application of spray-applied fireproofing. Surfaces to receive sprayed fire protection may be primed or painted only as permitted by UL-05. Applications listed for use on primed surfaces shall be coordinated with the manufacturer and detailed in submittal item SD-01 Data.

3.2 Protection

Surfaces not to receive spray-applied fireproofing shall be covered to prevent contamination by splatter, rebound and overspray. Exterior openings in areas to receive spray-applied fireproofing shall be covered prior to and during application of fireproofing with tarpaulins or other approved material. Surfaces not to receive fireproofing shall be cleaned of fireproofing and sealer.

3.3 MIXING

Fireproofing material shall be mixed in accordance with the manufacturer's recommendations.

3.4 APPLICATION

3.4.1 Sequence

Prior to application of fireproofing on each floor, the manufacturer shall inspect and approve application equipment, water supply and pressure, and the application procedures. Fireproofing shall be applied to underside of steel roof deck or steel floor assemblies only after respective roof or floor construction is complete. Fireproofing material shall be applied prior to the installation of ductwork, piping and conduits which would interfere with uniform application of the fireproofing. No roof traffic shall be allowed during application and curing period.

3.4.2 Application Technique

Water pressure and volume shall be maintained to manufacturer's recommendations throughout the fireproofing application. Fireproofing material shall be applied to the thickness established for the specified fire resistance rating, in accordance with the procedure recommended by the manufacturer, and to a uniform density and texture. Fireproofing material shall not be tamped to achieve the desired density. Sealer shall be applied to all fireproofing.

3.5 FIELD TESTS

The applied fireproofing shall be tested in approved locations for density, and cohesion/adhesion force as specified, and for thickness in accordance with ASTM E 605, by an approved independent testing laboratory. Two sets of tests shall be conducted on each floor or 930 square meter area, whichever is less, at the approved locations. Any area showing less than minimum requirements shall be rejected and corrected. Proposed corrective measures, in writing, shall be approved before starting the corrective action. Corrected work shall be retested.

3.5.1 Thickness, Density, Cohesion/Adhesion

Each structural component type shall be tested at floor and roof decks (flat portion), beams (bottom flange and web) and columns. Minimum average thickness shall be as required by UL-05. Density and cohesion/adhesion shall be as specified.

3.5.2 Repair

Additional fireproofing material may be added to provide proper thickness. Rejected areas of fireproofing shall be corrected to meet specified requirements by adding fireproofing material to provide the proper thickness, or by removing defects and respraying with new fireproofing material. Repairs shall use same type of fireproofing material as originally applied. Repaired areas shall be retested and reinspected. Fireproofing material shall be applied to voids or damaged areas by hand-trowel, or by respraying.

3.5.3 Manufacturer's Inspection

The manufacturer shall inspect the fireproofing work after the work is completed on each floor or area, including testing, repair and clean-up, and shall certify that the work complies with the manufacturer's criteria and recommendations. Before the sprayed material is covered, and after all of the 77 fireproofing work is completed, including repair, testing, and clean-up; and after mechanical, electrical and other work in contact with fireproofing material has been completed, the manufacturer shall re-inspect the work and certify that the entire project complies with the manufacturer's criteria and recommendations.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 07250
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
			Fireproofing Material; GA.										
			SD-09 Reports										
			Test; GA.										
			SD-13 Certificates										
			Installer Qualifications; GA.										
			Surface Acceptability; GA.										
			SD-14 Samples										
			Spray-Applied Fireproofing; GA.										
			with the manufacturer and detailed in submittal item SD-01 Data.										

SAFETY PAYS

SECTION 07270

FIRESTOPPING
08/95

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1.1 REFERENCES 07270-1
1.2 SUBMITTALS 07270-1
1.3 GENERAL REQUIREMENTS 07270-2
1.4 STORAGE AND DELIVERY 07270-2
1.5 INSTALLER QUALIFICATIONS 07270-2

PART 2 PRODUCTS 07270-2
2.1 FIRESTOPPING MATERIALS 07270-2

PART 3 EXECUTION 07270-3
3.1 PREPARATION 07270-3
3.2 INSTALLATION 07270-3
3.3 INSPECTION 07270-4

SAFETY PAYS

SECTION 07270

FIRESTOPPING
08/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84	(1995a) Surface Burning Characteristics of Building Materials
ASTM E 814	(1994b) Fire Tests of Through-Penetration Fire Stops

UNDERWRITERS LABORATORIES (UL)

UL-01	(1995) Building Materials Directory
UL-05	(1995) Fire Resistance Directory
UL 723	(1993; Rev Apr 1994) Test for Surface Burning Characteristics of Building Materials
UL 1479	(1994) Fire Tests of Through-Penetration Firestops

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Firestopping Materials; GA.

Detail drawings including manufacturer's descriptive data, typical details, installation instructions and the fire-test data and/or report as appropriate for the fire resistance rated construction and location. Submittal shall indicate the firestopping material to be provided for each type of application. When more than 5 penetrations are to receive firestopping, drawings shall indicate location and type of application.

SD-13 Certificates

Firestopping Materials; GA.

Certificates attesting that firestopping material complies with the specified requirements. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing agency equipped to perform such services, stating that the items have been tested and conform to the specified requirements and testing methods of the specified agency.

Installer Qualifications; FIO.

Manufacturer's certification stating that each installer is qualified and trained to install the specified firestopping material.

1.3 GENERAL REQUIREMENTS

Firestopping shall consist of furnishing and installing a material or a combination of materials to form an effective barrier against the spread of smoke, gases and prevent their infiltration of floor to deck partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints. See Wall Type drawings for applications of firestopping for all floor to bottom of deck walls and firestopping for fire walls.
Also, firestopping shall consist of furnishing and installing a material or a combination of materials to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints. Through-penetrations include, but are not limited to, the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

1.4 STORAGE AND DELIVERY

Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

1.5 INSTALLER QUALIFICATIONS

Each installer of firestopping material shall be trained and have a minimum of 5 years experience in the installation of firestopping of the type specified.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Firestopping materials shall consist of commercially manufactured products complying with the following minimum requirements:

2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, a smoke developed rating of 50 or less, and a fuel contribution of 50 or less when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL-05.

2.1.2 Toxicity

Material shall be nontoxic to humans at all stages of application and during fire conditions.

2.1.3 Fire Resistance Rating

Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being placed.

2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479. Fire resistance ratings shall be the following:

a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = one hour, T Rating = one hour.

b. Penetrations of Fire Resistance Rated Floors and Ceiling-Floor Assemblies: F Rating = one hour, T Rating = one hour.

2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph GENERAL REQUIREMENTS, and gaps such as those between floor slabs, roof decks, expansion joints, construction joints, wind or seismic movement shall be the same as the construction in which they occur.

2.1.4 Material Testing and Listing

All products shall have been tested per ASTM E 814 or UL 1479. The firestopping products shall be listed in the UL-01 or certified by a nationally recognized laboratory to meet the specified requirements and application. The ratings shall apply only to the complete systems as used in the particular applications. Individual components cannot be interchanged between systems. The materials used in the firestopping applications must match the tested applications.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting, gas infiltration or fire resistance of the firestopping system.

3.2 INSTALLATION

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping for filling floor voids 100 mm or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Cutting and patching of construction and providing sleeves, where required, are shown in the drawings or specified in other sections. Firestopping shall be installed at locations shown or specified in accordance with manufacturer's written instructions. Firestopping shall be

provided in the following locations, except in floor slabs on grade:

a. Duct, conduit, tubing, cable and pipe penetrations through above grade floor slabs and through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.

b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.

c. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.

d. Construction, control and expansion joints in floors and fire rated walls and partitions.

e. Other locations where required to maintain fire resistance rating of the construction.

f. Firestopping shall be installed in both fire rated walls and all floor to bottom of deck walls for both fire and smoke spread prevention.

3.2.1 Pipe and Ductwork

3.2.1.1 Piping

Insulated or uninsulated piping penetrating fire resistance rated assemblies shall be firestopped as listed in UL-01.

3.2.1.2 Ductwork

Ductwork penetrating 1 hour assemblies without a fire damper, insulated or uninsulated, shall have the voids between the the ductwork or insulation and the prepared opening filled with firestopping material. The material shall be installed as recommended by the manufacturer.

3.2.2 Fire Dampers

Fire dampers in ducts and penetrations of fire resistance rated construction shall be furnished and installed in accordance with the requirements in Section C-15895 AIR SUPPLY AND DISTRIBUTION SYSTEM.

3.2.3 Electrical Cables and Conduits

Electrical cables or conduit penetraring fire resistance rated assemblies shall be firestopped as listed in the Underwriters Laboratories. Firestopping at penetrations shall also comply with the requirements of NFPA 70.

3.2.4 Control and Expansion Joints

Continuously fill all voids occuring behind control or expansion joints located in fire-resistance-rated partitions, ceilings or floor with firestopping material for the full length of the joints. Firestopping material shall not be attached to wall or ceiling panels themselves.

3.3 INSPECTION

Firestopped areas shall not be covered or enclosed until inspection is complete and approved.

SAFETY PAYS

--END OF SECTION- -

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 07270
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO.	TRANS-MITTAL NO.	ITEM NO.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER	REV-IEW-ER	SUBMIT	APPROV. NEEDED BY	MATER. NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
a.	b.	c.	d. through q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
			PAR. NO. SD-04 Drawings										
		1	Firestopping Materials; GA.										
			SD-13 Certificates										
		2	Firestopping Materials; GA.										
		3	Installer Qualifications; FIO.										

SAFETY PAYS

SECTION 07412

NON-STRUCTURAL METAL ROOFING

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1.4 PERFORMANCE REQUIREMENTS 07412-4
1.5 SUBMITTALS 07412-4
1.6 DELIVERY AND STORAGE 07412-5
1.7 WARRANTIES 07412-5
1.8 PRE-SUBMITTAL / PRE-APPROVAL COORDINATION MEETING 07412-6

PART 2 PRODUCTS 07412-6
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3.1 INSTALLATION 07412-9
3.2 INSULATION INSTALLATION 07412-10
3.3 NOT USED 07412-10
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3.6 INSULATION 07412-11
3.6 CLEANING AND TOUCH-UP 07412-11

*** SAFETY PAYS ***

SECTION 07412

NON-STRUCTURAL METAL ROOFING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463	(1996a) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 653	(1996) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 792	(1995) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM B 117	(1994) Operating Salt Spray (Fog) Testing Apparatus
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 518	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 612	(1993) Mineral Fiber Block and Board Thermal Insulation
ASTM C 991	(1992) Flexible Glass Fiber Insulation for Pre-Engineered Metal Buildings
ASTM C 1289	(1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 226	(1994) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 522	(1993a) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1994) Specular Gloss
ASTM D 714	(1987; R 1994) Evaluating Degree of Blistering of Paints
ASTM D 968	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 1308	(1987; R 1993) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASTM D 2244	(1993) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(1994) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1995) Measuring Adhesion by Tape Test
ASTM D 4214	(1989) Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4397	(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D 4587	(1991) Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water- Exposure Apparatus
ASTM E 84	(1996a) Surface Burning Characteristics of Building Materials
ASTM E 96	(1995) Water Vapor Transmission of Materials

UNDERWRITERS LABORATORIES (UL)

UL 580	(1998) Tests for Uplift Resistance of Roof Assemblies.

1.2 GENERAL REQUIREMENTS

The Contractor shall furnish a manufacturer's standard product which satisfies the specified design and additional requirements contained herein. The concealed clip roofing system shall be provided by the Contractor as a complete system as tested and approved in accordance with UL-580. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same manufacturer.

1.2.1 Non-Structrual Metal Roof System

The non-structural metal roofing system shall be the product of a manufacturer who has been in the practice of manufacturing metal roofs for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project.

1.2.2 Installer

The installer shall be certified by the metal roof manufacturer to have experience in installing at least three projects that are of comparable size, scope and complexity as this project for the particular roof system furnished. The installer may be either employed by the manufacturer or be an independent installer.

1.3 DESIGN LOADS

1.3.1 Wind Uplift Pressures

Wind uplift pressures are shown on the contract drawings. Non-Structrual Metal Roof System assemblies shall be approved to resist wind uplift pressures of Class 90 as defined in UL-580.

1.3.2 Thermal Loads

Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of 122_degrees C during the life of the structure.

1.4 PERFORMANCE REQUIREMENTS

The metal roofing system supplied shall be suitable for the roof slope, the underlayment, and uplift pressures shown on the contract drawings. The Contractor shall furnish a manufacturer's product, which satisfies all requirements contained herein and has been verified by load testing and independent design analyses to meet the specified design requirements.

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Metal Roofing; GA.

a. Drawings consisting of catalog cuts, erection drawings, shop coating and finishing specifications, and other data as necessary to clearlydescribe materials, sizes, layouts, construction details, fasteners, and eerection.

b. Drawings consisting of UL tested assemblies showing The roofing system assembly is approved as Class 90 uplift resistance in accordance with UL-580.

SD-13 Certificates

Roof Panels; FIO.

Installation; FIO.

Accessories; FIO.

Certificates attesting that the panels and accessories conform to the specified requirements. Certificate for the roof assembly shall certify that the assembly complies with the material and fabrication requirements specified and is suitable for the installation at the indicated design slope. Certified laboratory test reports showing that the sheets to be furnished are produced under a continuing quality control program and that at least five (5) representative samples of similar material to that which will be provided on this project have been previously tested and have met the quality standards specified for factory color finish.

Insulation; FIO.

Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

Installer; FIO.

Certification of installer.

Warranties; FIO.

At the completion of the project, signed copies of the 5-year Warranty for Non-Structural Metal Roofing System, a sample copy of which is attached to this section, and the 20-year Manufacturer's Material /and Weathertightness/ Warranties.

SD-14 Samples

Accessories; FIO.

One sample of each type of flashing, trim, fascia, closure, cap and similar items. Size shall be sufficient to show construction and configuration.

Roof Panels; FIO.

One piece of each type and finish to be used, 225 mm long, full width.

Fasteners; FIO.

Two samples of each type to be used with statement regarding intended use. If so requested, random samples of screws, bolts, nuts, and washers as delivered to the jobsite shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Gaskets and Insulating Compounds; FIO.

Two samples of each type to be used and descriptive data.

Sealant; FIO.

One sample, approximately 0.5 kg, and descriptive data.

1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weather tight coverings and kept dry. Material shall not be covered with plastic where such covering will allow sweating and condensation. Plastic may be used as tenting with air circulation allowed. Storage conditions shall provide good air circulation and protection from surface staining.

1.7 WARRANTIES

The Non-Structural Metal Roofing System shall be warranted as outlined below. Any emergency temporary repairs conducted by th eowner shall not negate the warranties.

1.7.1 Contractor's Weathertightness Warranty

The Non-Structrual Metal Roof System shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by exposure to the elements and service design loads, water leaks, and wind uplift damage. The SSSMR system covered under this warranty shall include All material and workmanship deficiencies, system deterioration caused by exposure to the elements and service design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor supplement this warranty with written warranties from the installer and system manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR NON-STRUCTURAL METAL ROOF SYSTEM, and shall start upon final acceptance of the facility. It will remain effective throughout the five year Contractor's warranty period for the entire SSSMR system as outlined above.

1.7.2 Manufacturer's Material Warranties

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all Non-Structural Metal Roofing System components such as roof panels, flashing, accessories, and trim, fabricated from coil material:

a. A manufacturer's 20 year material warranty warranting that the aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture, fail structurally, or perforate under normal atmospheric conditions at the site. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material.

b. A manufacturer's 20 year exterior material finish warranty warranting that the factory color finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of 8 when measured in accordance with ASTM D 4214; or fade or change colors in excess of 5 NBS units as measured in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing or replacing the defective coated coil material.

1.8 PRE-SUBMITTAL / PRE-APPROVAL COORDINATION MEETING

A coordination meeting shall be held within 45 days after contract sward for mutual understanding of the metal roofing contract requirements. This meeting shall take place at the SSSRM system manufacturer’s home office and shall include representatives from the Contractor, the SSSMR supplier, the erector, the manufacturer, the designer, and the Contracting Officer. All items required by paragraph 1.5 SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

PART 2 PRODUCTS

2.1 ROOF PANELS

Panels shall be steel and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 9 m.. Sheets longer than 9 m may be furnished if approved by the Contracting Officer. Width of sheets shall provide nominal 300 mm of coverage in place. Design provisions shall be made for thermal expansion and contraction consistent with the type of system to be used. All sheets shall be either square-cut or miter-cut. The ridge cap shall not have exposed fasteners. Height of corrugations, ribs, or seams, at overlap of adjacent roof sheets shall be the building manufacturer's standard for the indicated roof slope.

2.1.1 Steel Panels

Zinc-coated steel conforming to ASTM A 653; aluminum-zinc alloy coated steel conforming to ASTM A 792, AZ 50 coating; or aluminum-coated steel conforming to ASTM A 463, Type 2, coating designation T2 65. Uncoated roof panels shall be 0.6 mm 0.024 inchthick minimum. Panels shall be within 95 percent of the nominal thickness. Prior to shipment, mill finish panels shall be treated with a passivating chemical and oiled to inhibit the formation of oxide corrosion products. Panels that have become wet during shipment and have started to oxidize shall be rejected.

2.1.2 Steel Panel Coordination

Selection of steel roof panels shall be coordinated with specification Section 07413 METAL SIDING, FACTORY-COLOR-FINISH for same material, color, profile and finish. Also coordinate selection of steel roof panel color and finish with specification SECTION 07600 SHEET METAL, GENERAL for gutter, downspouts, straps and other accessories.

2.2 CONCEALED ANCHOR CLIPS

Clip bases shall have factory punched or drilled holes for attachment. Clips shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip. Single piece clips may be

acceptable when the manufacturer can substantiate that the system can accommodate the thermal cyclic movement under sustained live or snow loads.

2.3 ACCESSORIES

Accessories shall be compatible with the roofing system furnished, and be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system Flashing, trim, metal closure strips, caps, and similar metal accessories shall be not less than the minimum thicknesses specified for roof panels. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water.

2.4 FASTENERS

Fasteners for roof panels shall be zinc-coated steel or nylon capped steel, type and size as recommended by the manufacturer to meet the performance requirements. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be gasketed or have gasketed washers on the exterior side of the roofing to waterproof the fastener penetration. Washer material shall be compatible with the panels; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 3 mm thick.

2.5 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated on the drawings. The exterior coating shall be a nominal 0.025 mm thickness consisting of a topcoat of not less than 0.018 mm dry film thickness and the paint manufacturer's recommended primer of not less than 0.005 mm thickness. The exterior color finish shall meet the test requirements specified below.

2.5.1 Salt Spray Test

A sample of the sheets shall withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B 117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 8F, few no. 8 blisters, as determined by ASTM D 714; and a rating of 6, 3 mm failure at scribe, as determined by ASTM D 1654.

2.5.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 3 mm diameter mandrel, the coating film shall show no evidence of fracturing to the naked eye.

2.5.3 Accelerated Weathering, Chalking Resistance and Color Change

The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244.

2.5.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.5.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 13 mm diameter hemispherical head indenter, equal to 6.7 times the metal thickness in mm, expressed in N-meters, with no loss of adhesion.

2.5.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel base metal.

2.5.7 Not Used

2.5.8 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.6 UNDERLAYMENTS

2.6.1 Felt Underlayment

Felt underlayment shall be No. 30 felt in accordance with ASTM D 226, Type II.

2.6.2 Not Used

2.6.3 Slip Sheet

Slip Sheet shall be 0.24 kg per square meter rosin sized unsaturated building paper.

2.6.4 Underlayment / Thermal Barrier

Provide water resistant Type X, fire rated gypsum core panel 16mm thick with glass mat facers secured to metal deck as recommended by roofing system manufacturer.

2.7 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined at a mean temperature of 24 degrees C in accordance with ASTM C 518. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Insulation shall have a flame spread not in excess of 75 and a smoke developed rating not in excess of 150 when tested in accordance with ASTM E 84, or the entire roof/deck construction assembly , including insulation shall be listed as fire classified. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory.

2.7.1 Rigid Board Insulation for Use Above a Roof Deck

2.7.1.1 Polyurethane or Polyisocyanurate

Polyurethane or polyisocyanurate insulation shall conform to ASTM C 1289, Type I, Class 2 (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). For impermeable faced polyisocyanurate (Ex: aluminum foil) the maximum design R-value per 25 mm of insulation used shall be 1.27.

2.7.2 Blanket Insulation

Blanket insulation shall conform to ASTM C 991.

2.8 NOT USED

2.9 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubberlike consistency.

2.10 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

2.11 VAPOR RETARDER

2.11.1 Not Used

2.11.2 Vapor Retarders Separate from Insulation

Vapor retarder material shall be polyethylene sheeting conforming to ASTM D 4397. A single ply of 0.25 mm polyethylene sheet; or, at the Contractor's option, a double ply of 0.15 mm polyethylene sheet shall be used. A fully compatible polyethylene tape which has equal or better water vapor control characteristics than the vapor retarder material shall be provided. A cloth industrial duct tape in a utility grade shall also be provided to use as needed to protect the vapor retarder from puncturing.

2.11.3 Slip Sheet for Use With Vapor Retarder

Slip sheet for use with vapor retarder shall be a 0.24 kg per square meter rosin-sized, unsaturated building paper.

2.12 EPDM RUBBER BOOTS

Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber. Rubber boot material shall be as recommended by the manufacturer. The boots shall have base rings made of aluminum or corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

3.1.1 Roofing

Side laps shall be laid away from the prevailing winds. Side and end lap distances, joint sealing, and fastening and spacing of fasteners shall be in accordance with manufacturer's standard practice. Spacing of exposed fasteners shall present an orderly appearance. Side laps and end laps of roof panels and joints at accessories shall be sealed. Fasteners shall be driven normal to the surface. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weathertight installation. Accessories shall be fastened into substrate, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction.

3.1.2 Concealed Anchor Clips

Concealed anchor clips shall be fastened directly to the structural framing members. Attachment to the substrate (when provided) or to the panels is not permitted. The maximum distance, parallel to the seams, between clips shall be 750 mm on center at the corner, edge, and ridge zones, and 1500 mm maximum on centers for the remainder of the roof.

3.1.3 Field forming of Roof Panels

When roofing panels are formed from factory-color-finished steel coils at the project site, the same care and quality control measures that are taken in shop forming of roofing panels shall be observed. Rollformer shall be operated by the metal roofing manufacturer's representative. In cold weather conditions, preheating of the steel coils to be field formed shall be performed as necessary just prior to the rolling operations.

3.1.4 Underlayment

Underlayment types shall be installed where shown on the drawings; they shall be installed directly over the substrate. If a roof panel rests directly on the underlayments, a slip sheet shall be installed as a top layer, beneath the metal roofing panels, to prevent adhesion. All underlayments shall be installed so that successive strips overlap the next lower strip in shingle fashion. Underlayments shall be installed in accordance with the manufacturer's written instructions. The underlayments shall ensure that any water that penetrates below the metal roofing panels will drain outside of the building envelope.

3.2 INSULATION INSTALLATION

Insulation shall be installed as indicated and in accordance with manufacturer's instructions. Insulation shall be continuous over entire roof surface. Where expansion joints, terminations, and other connections are made, the cavity shall be filled with batt insulation and vapor retarder providing equivalent R-Value and perm rating as remaining insulation.

3.2.1 Board Insulation

Rigid or semirigid board insulation shall be laid in close contact. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer. A layer of blanket insulation shall be placed over the rigid or semirigid board insulation to be compressed against the underside of the metal roofing to reduce thermal bridging, dampen noise, and prevent roofing flutter. This layer of unfaced blanket insulation shall be compressed a minimum of 50 percent. Rigid insulation shall be attached to the metal roof deck with bearing plates and fasteners, as recommended by the insulation manufacturer, so that the insulation joints are held tight against each other, with no less than 1 fastener and bearing plate per 0.37 square meter of insulation. Layout and joint pattern of insulation and fasteners shall be indicated on the shop drawings.

3.3 NOT USED

3.4 VAPOR RETARDER INSTALLATION

3.4.1 Not Used

3.4.2 Polyethylene Vapor Retarder

The polyethylene vapor retarder membrane shall be installed over the entire surface of the thermal barrier underlayment. A fully compatible polyethylene tape shall be used to seal the edges of the sheets to provide a vapor tight membrane. Sheet edges shall be lapped not less than 150 mm. Sufficient material shall be provided to avoid inducing stresses in the sheets due to stretching or binding. All tears or punctures that are visible in the finished surface at any time during the construction process shall be sealed with polyethylene tape.

3.5 Not Used

3.6 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined at a mean temperature of 24 degrees C in accordance with ASTM C 518. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Blanket insulation shall have a facing as specified in paragraph VAPOR RETARDERThe stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory.

3.6.1 Rigid Board Insulation for Use Above a Roof Deck

3.6.1.1 Polyisocyanurate

Polyisocyanurate insulation shall conform to ASTM C 1289, Type I, Class 2 (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). For impermeable faced polyisocyanurate (Ex: aluminum foil) the maximum design R-value per 25 mm of insulation used shall be 1.27.

3.6.1.2 Mineral Fiber

Insulation shall conform to ASTM C 612.

3.6.2 Blanket Insulation

Blanket insulation shall conform to ASTM C 991.

3.6 CLEANING AND TOUCH-UP

Exposed metal roof systems shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up with the manufacturer's recommended touch up paint.

End of Section

*** SAFETY PAYS ***

THE NON-STRUCTURAL METAL ROOF SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE AND LEAKAGE. THE STANDING SEAM METAL ROOFING SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING: THE ENTIRE ROOFING SYSTEM MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH ASTM E 1592. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE ROOF SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE AND LEAKAGE ASSOCIATED WITH THE NON-STRUCTURAL METAL ROOF SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

_____

(Company President) (Date)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE NON-STRUCTURAL METAL ROOF SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THE THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY. EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).

2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.

3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.

4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.

5. FAILURE OF ANY PART OF THE NON-STRUCTURAL METAL ROOF DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.

6. THIS WARRANTY APPLIES TO THE NON-STRUCTURAL METAL ROOF SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.

7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

REPORTS OF LEAKS AND ROOF SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE BY TELEPHONE OR IN WRITING FROM EITHER THE OWNER, OR CONTRACTING OFFICER. EMERGENCY REPAIRS, TO PREVENT FURTHER ROOF LEAKS, SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS ROOF SYSTEM WITHIN SEVEN CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT

AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE NON-STRUCTURAL METAL ROOF SYSTEM REPAIRED OR REPAIRED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR. IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT HE MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION, UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED THE PARTIES SHALL, WITHIN 10 DAYS JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN 10 DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. a WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

END

***** SAFETY PAYS *****

SECTION 07413

METAL SIDING, FACTORY-COLOR-FINISH
07/9

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SAFETY PAYS

SECTION 07413

METAL SIDING, FACTORY-COLOR-FINISH
07/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI-01 (1987) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84 (1995a) Surface Burning Characteristics of Building Materials

1.2 DESIGN REQUIREMENTS

Contract drawings indicate the design loads and the extent and general assembly details of the prefabricated insulated metal panel. Members and connections not indicated on the drawings shall be designed by the Contractor. All siding panels, components, transitions, and assemblies shall be the products of the standing seam metal roof manufacturer and shall be of the same manufacturer. Roof system shall comply with requirements in Section 07412 NON-STRUCTURAL METAL ROOFING. Steel covering shall be designed in accordance with AISI SG-673.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES :

SD-04 Drawings

Metal Siding; GA.

Drawings consisting of catalog cuts, design and erection drawings, shop coating and finishing specifications, and other data as necessary to clearly describe design, materials, sizes, layouts, construction details, fasteners, and erection. Drawings shall be accompanied by engineering design calculations for the structural properties of siding units. Section modulus and moment of inertia of steel sheet be determined in accordance with AISI SG-673. Section modulus and moment of inertia of aluminum sheet will be determined for actual cross section dimensions by the conventional methods for actual design stresses and by effective width concept for deflection in accordance with AA SAS-30.

SD-13 Certificates

Prefabricated Wall Panels; FIO.

Installation; FIO.

Accessories; FIO.

Certificates attesting that the panels and accessories conform to the requirements specified. Certified laboratory test reports showing that the type of panels being delivered has been tested and conforms to applicable provisions specified herein.

SD-14 Samples

Accessories; FIO.

One sample of each type of flashing, trim, closure, cap and similar items. Size shall be sufficient to show construction and configuration.

Prefabricated Wall Panels; FIO.

One piece of each type to be used, 225 mm long, full width, accompanied by certified laboratory test reports showing that the sheets to be furnished are produced under a continuing quality control program and that a representative sample has been tested and has met the quality standards specified for factory color finish.

Fasteners; FIO.

Two samples of each type to be used with statement regarding intended use.

Gaskets and Insulating Compounds; FIO.

Descriptive data.

Sealant; FIO.

One sample, approximately 0.5 kg, and descriptive data.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage accommodations for roof and wall covering shall provide good air circulation and protection from surface staining.

1.5 MANUFACTURER'S GUARANTEE

Notwithstanding the requirements of clause "Warranty of Construction" specified in the SPECIAL CLAUSES, the wall system shall be guaranteed against materials and/or workmanship not in conformance with the drawings or specifications for 5 years. The guarantee shall require the contractor and supplier to replace/repair non-

conforming materials and workmanship during the guarantee period.

PART 2 PRODUCTS

2.1 Prefabricated Insulated Panels

Insulated wall units shall be factory-fabricated units with embossed flat pan profile with insulating core between metal face sheets, securely fastened together and uniformly separated into with rigid spacers, exterior facing of steel or aluminum of composition and gauge specified, interior face shall be 26 ga. constructed in a manner that will eliminate condensation on interior of panel for exterior face sheet .6 mm for interior face .4 mm. Panels shall have a factory color finish. Insulation shall be compatible with adjoining materials; U-value of assembled panel not to exceed .2666 watts per kelvin per sq. meter (Conversion: Btu/hr. F sq. ft. x 5.673 = watts per kelvin per sq. meter) difference when determined for winter conditions in accordance with recognized methods in agreement with the ASHRAE Handbook; nonrunning and nonsettling; capable of retaining its R-value for the life of the metal facing sheets; and uneffected by extremes of temperature and humidity. The assembly shall have a flame spread rating not higher than 25, and smoke developed rating not higher than 160 when tested in accordance with ASTM E 84. The insulation shall remain odorless, free from mold, and not become a source of food and shelter for insects. Units shall be not less than 203 mm wide or greater than a width that will allow "oil canning" and shall be in one piece for unbroken wall heights up to 7.3 meters.

2.1.1 Steel Panels

Steel panels are specified in Section 07412 NON-STRUCTURAL METAL ROOFING.

2.1.2 Steel Panel Coordination

Selection of steel panels shall be coordinated with specification Section 07412 NON-STRUCTURAL METAL ROOFING for same material, color, profile and finish. Also coordinate selection of steel panel color and finish with specification SECTION 07600 SHEET METAL, GENERAL for gutter, downspouts, straps and other accessories.

2.2 FACTORY COLOR FINISH

Factory color finish shall conform to requirements in Section 07412 NON-STRUCTURAL METAL ROOFING.

2.2.1 Salt Spray Test

Salt spray test shall conform to requirements in Section 07412 NON-STRUCTURAL METAL ROOFING.

2.2.2 Formability Test

Formability test shall conform to requirements in Section 07412 NON-STRUCTURAL METAL ROOFING.

2.2.3 Accelerated Weathering, Chalking Resistance and Color Change

Accelerated weathering, chalking resistance and color change shall conform to requirements in Section 07412 NON-STRUCTURAL METAL ROOFING.

2.2.4 Humidity Test

Humidity test shall conform to requirements in Section 07412 NON-STRUCTURAL METAL ROOFING.

2.2.5 Impact Resistance

Impact resistance shall conform to requirements in Section 07412 NON-STRUCTURAL METAL ROOFING.

2.2.6 Abrasion Resistance Test

Abrasion resistance test shall conform to requirements in Section 07412 NON-STRUCTURAL METAL ROOFING.

2.2.7 Specular Gloss

Specular gloss shall conform to requirements in Section 07412 NON-STRUCTURAL METAL ROOFING.

2.3 ACCESSORIES

Accessories shall be compatible with the covering furnished. Flashing, trim, metal closure strips, caps, and similar metal accessories shall be not less than the minimum thicknesses specified for covering. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the covering and shall not absorb or retain water.

2.4 FASTENERS

Fasteners shall be zinc-coated steel, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Exposed fasteners shall be gasketed or have gasketed washers on the exterior side of the covering to waterproof the fastener penetration. Washer material shall be compatible with the covering; have a minimum diameter of 9 mm for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 3 mm thick. Fasteners used for structural connectors may be the same fasteners used for holding laps, except that they shall provide both tensile and shear strength of not less than 349 kg per fastener. Exposed wall fasteners shall be color finished or provided with plastic color caps to match the covering. Nonpenetrating fastener system for wall panels using concealed clips shall be manufacturer's standard for the system provided.

2.4.1 Screws

Screws shall be not less than No. 14 diameter if self-tapping type and not less than No. 12 diameter if self-drilling and self-tapping type.

2.4.2 End-Welded Studs

Automatic end-welded studs shall be shouldered type with a shank diameter of not less than 5 mm and cap or nut for holding covering against the shoulder.

2.4.3 Explosive Actuated Fasteners

Fasteners for use with explosive actuated tools shall have a shank of not less than 3.68 mm with a shank length of not less than 13 mm for fastening panels to steel and not less than 25 mm for fastening panels to concrete. Fasteners for securing wall panels shall have threaded studs suitable for attaching approved color-coated nuts or caps.

2.4.4 Rivets

Blind rivets shall be aluminum with 5 mm nominal diameter shank or stainless steel with 3 mm nominal diameter shank. Rivets shall be threaded stem type if used for other than the fastening of trim. Rivets with hollow stems shall have closed ends.

2.4.5 Bolts

Bolts shall be not less than 6 mm diameter, shouldered or plain shank as required, with proper nuts.

2.5 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall cure to a rubberlike consistency. Concealed sealant may be the nonhardening type.

2.6 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

2.7 Cold Formed Supporting Structural Members

Cold formed supporting structural members, including subpurlins, shall have a minimum thickness of 1.5 mm and a minimum grade 50 tensile yield strength. Other types of structural members shall have a minimum thickness of 6.4 mm and a minimum grade 36 tensile yield strength.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be as specified and in accordance with the approved erection instructions and drawings. Finish structure shall be proven weathertight. Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

3.1.1 Wall Panel Installation

Prefabricated insulated wall panels shall be applied with the longitudinal configurations in the vertical position. Method of applying joint sealant shall conform to the manufacturer's recommendations. Accessories shall be fastened into framing members, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction.

3.1.1.2 Concealed Fastener Wall Panels

Panels shall be fastened to framing members with concealed fastening clips or other concealed devices standard with the manufacturer. Spacing of fastening clips and fasteners shall be in accordance with the manufacturer's written instructions insofar as the maximum fastener spacings specified are not exceeded and provided such standard practice will result in a structure which will be free from water leaks and meet design requirements. Spacing of fasteners and anchor clips along the panel interlocking ribs shall not exceed 300 mm on center except when otherwise approved. Fasteners shall not puncture covering sheets except as approved for flashing, closures, and trim; exposed fasteners shall be installed in straight lines. Interlocking ribs shall be sealed with factory-applied sealant. Joints at accessories shall be sealed.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 07413
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. SD-04 Drawings										
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			SD-13 Certificates										
		2	Prefabricated Wall Panels; FIO.										
		3	Installation; FIO.										
		4	Accessories; FIO.										
			SD-14 Samples										
		5	Accessories; FIO.										
		6	Prefabricated Wall Panels; FIO.										
		7	Fasteners; FIO.										
		8	Gaskets and Insulating Compounds; FIO.										
		9	Sealant; FIO.										

SAFETY PAYS

SECTION 07535

MODIFIED BITUMEN ROOFING
06/95

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SECTION 07535

MODIFIED BITUMEN ROOFING
06/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 208	(1995) Cellulosic Fiber Insulating Board
ASTM C 1153	(1990) The Location of Wet Insulation in Roofing Systems Using Infrared Imaging
ASTM D 41	(1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 312	(1995) Asphalt Used in Roofing
ASTM D 517	(1992) Asphalt Plank
ASTM D 2824	(1994) Aluminum-Pigmented Asphalt Roof Coatings, Non-Fibered, Asbestos Fibered, and Fibered without Asbestos
ASTM D 3746	(1985; R 1996) Impact Resistance of Bituminous Roofing Systems
ASTM D 4586	(1993) Asphalt Roof Cement, Asbestos Free
ASTM D 4897	(1994) Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
ASTM D 5147	(1991) Sampling and Testing Modified Bituminous Sheet Material

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825c	(1996) Approval Guide Building Materials

UNDERWRITERS LABORATORIES (UL)

UL-01	(1997) Building Materials Directory
UL 790	(1995) Tests for Fire Resistance of Roof Covering Materials
UL 1256	(1993; Rev thru Apr 1996) Fire Test of Roof Deck Constructions

1.2 SYSTEM DESCRIPTION

The modified bitumen roofing system shall consist of a manufacturer's standard, prefabricated, reinforced polymer-modified bitumen membrane, with base sheet, and insulation as specified and indicated. The manufacturer shall have a minimum of 5 years experience in manufacturing of the proposed modified bitumen sheet roofing for similar applications.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Modified Bitumen roof layout; GA.

Submit membrane manufacturers roof plan drawing with flashing and installation details.

SD-06 Instructions

Materials and Installation; FIO.

Manufacturer's instructions, including membrane description and performance data, detailed procedure for installation, and safety precautions, prior to the start of roofing work.

SD-13 Certificates

Qualifications; FIO.

Evidence that the manufacturer has a minimum of 5 years experience manufacturing modified bitumen roofing. The roofing system applicator shall be approved by the modified bitumen roofing manufacturer, and shall have a minimum of 3 years experience as an approved applicator. A list of installations using the same products and applicator as proposed shall be included.

Materials; FIO.

Certificates of compliance for felts, bitumens, and membrane sheet.

SD-18 Records

Bills of Lading; FIO.

Bills of lading shall indicate the flash point and equiviscous temperature (EVT) and this information shall be shown on labels for each unit (or plug) of asphalt.

1.4 STORAGE OF MATERIALS

Felts and roofing sheets shall be kept dry before, during, and after delivery to the site. Felts and roofing sheets shall be stored on end one level high, in an enclosed building or trailer and on platforms, off the deck or floor. Felts and sheets shall be maintained at a temperature above 10 degrees C 50 degrees F for 24 hours immediately before laying.

1.5 COORDINATION REQUIREMENTS

The work shall be coordinated with other trades to ensure that components are available when they are to be secured or stripped into the roofing system.

1.5.1 Insulation

Application of roofing shall immediately follow application of insulation as a continuous operation.

1.5.2 Flashings

Modified bituminous sheet shall be used for flashings where the roof deck abuts angles, vertical surfaces, edge metal, and penetrations, unless otherwise specified or indicated. Flashing shall be installed as the work progresses.

1.5.3 Sheet Metalwork

Sheet metalwork specified in Section 07600 SHEET METALWORK, GENERAL shall be coordinated with roofing operations.

1.6 ENVIRONMENTAL CONDITIONS

Air temperature shall be above 4 degrees C and there shall be no visible ice, frost, or moisture on the roof deck at the time roofing is installed. When air temperature is less than 4 degrees C, 40 degrees F, kettles shall be insulated, felts and sheets shall be kept warm, and the application site shall be protected.

1.7 FLAME HEATED EQUIPMENT

Flame heated kettles shall not be placed on the roof. Torch application shall be approved by the membrane manufacturer for the specific modified bitumen. Open flame equipment shall not be left unattended while ignited.

1.8 ELECTRIC-HEATED EQUIPMENT

Adequate electrical service shall be provided as required by the manufacturer of the equipment, to insure proper application of the roofing materials.

1.9 FIRE AND WIND UPLIFT REQUIREMENTS

The complete roof system shall have a UL 790, Class A or B classification, be listed as "fire classified" in UL-01, and bear the UL label or be listed as a Class I Roof Deck in FM P7825c. Roofing systen over steel deck shall be rated Class I-90 in accordance with FM P7825c. Ratings from other independent laboratories may be substituted provided that the tests, requirements and ratings are documented to be equivalent, to the satisfaction of the Contracting Officer.

1.10 WARRANTY

Manufacturer's standard warranty for the roofing system shall be provided for not less than 10 years from acceptance of the work. Warranty shall state that manufacturer shall repair or replace defective materials if the roofing system leaks or allows the insulation beneath the membrane to become wet during the period of the warranty.

PART 2 PRODUCTS

2.1 PRIMER

Primer shall conform to ASTM D 41.

2.2 ASPHALT

Asphalt shall conform to ASTM D 312, Type III for slopes up to 25 percent (1/4 vertical/horizontal) and Type IV for slopes up to 50 percent (1/2 vertical/horizontal).

2.3 BITUMINOUS CEMENT

Bituminous cement shall conform to ASTM D 4586.

2.4 CANTS AND WOOD NAILERS

Treated wood cants and wood nailers shall be of water-borne preservative-treated material as specified in Section 06100 ROUGH CARPENTRY. Cants shall be made from treated wood or treated fiberboard not less than 89 mm high and cut to reduce change in direction of the membrane to 45 degrees or less. Fiberboard shall conform to

ASTM C 208, treated with sizing, wax or bituminous impregnation. When membrane or flashing is to be torch applied, cants shall be fire resistant.

2.5 BASE SHEET

Venting inorganic felt base sheet shall conform to ASTM D 4897, Type II.

2.6 MODIFIED BITUMEN SHEET

Modified bitumen sheet shall be a bitumen modified by styrene butadiene styrene (SBS); or modified by SBS which has been further modified with styrene ethylene butadiene styrene (SEBS). Sheets shall be uniform in thickness and appearance, and free from blisters or tape splices. Sheets shall not stick to the roll or stack, and shall be suitable for joining along the entire length by the procedure recommended by the manufacturer. Sheet shall be reinforced with fiber made from glass, polypropylene, or polyester, and shall meet the following requirements:

MODIFIED BITUMEN SHEET PROPERTIES

Maximum Load/Elongation, ASTM D 5147, weakest (longitudinal or transverse) direction:

Maximum load, minimum	15 KN/m
Elongation, minimum; when reinforced with:	
glass fiber	3 percent
polyester or polypropylene	40 percent

Tear Strength, ASTM D 5147	
Minimum	356 N

Low Temperature Flexibility, ASTM D 5147 SBS: minus 26 degrees C

Impact Resistance, ASTM D 3746	No Damage

2.7 NAILS AND FASTENERS

Nails and fasteners shall be an approved type recommended by the roofing felt or membrane manufacturer.

2.8 SURFACING MATERIAL

Surfacing shall be factory applied granules requiring no further coating.

2.9 ADHESIVE

Adhesive shall be an approved type recommended by the membrane manufacturer.

2.10 WALKWAY SURFACES

Walkway surfaces shall be mineral surfaced modified bitumen cap sheet as recommended by the membrane manufacturer, minimum 19 mm thick.

2.11 INSULATION

Insulation shall be compatible with the membrane, as recommended by the membrane manufacturer's printed instructions, and as specified in Section 07220 ROOF INSULATION.

2.12 COATING

Aluminum coating shall conform to ASTM D 2824 Type I or III, or shall be as recommended by the membrane manufacturer.

PART 3 EXECUTION

3.1 PREPARATION REQUIREMENTS

The substrate construction of any bay or section of the building shall be completed before roofing work is begun thereon. Vents and other items penetrating the roof shall be secured in position and properly prepared for flashing. Nailers, curbs and other items attached to roof surface shall be in place before roofing is begun.

3.2 INSTALLATION OF CANTS

Cants shall be installed in the angles formed between the roof and walls or other vertical surfaces. Cants shall be laid in a solid coat of bituminous cement just prior to laying the base sheet or membrane. Cants shall be continuous, and shall be installed in lengths as long as practicable.

3.3 CONDITION OF SURFACES

Surfaces shall be inspected and approved immediately prior to application of roofing and flashings. The roofing and flashings shall be applied to a smooth and firm surface free from ice, frost, visible moisture, dirt, projections, and foreign materials. Prior to application of primer on precast concrete decks, joints shall be covered with a 100 mm strip of roofing felt, embedded in and coated with bituminous cement. Modified bitumen membrane shall be isolated from coal tar pitch.

3.4 MECHANICAL APPLICATION DEVICES

Mechanical application devices shall be mounted on pneumatic-tired wheels, and shall be designed and maintained to operate without damaging the insulation, roofing membrane, or structural components.

3.5 PRIMING

Concrete, masonry and metal surfaces to receive bitumen shall be uniformly coated with primer at a rate of not less than 0.4 liter per square meter and allowed to dry.

3.6 HEATING OF BITUMEN

Asphalt shall not be heated higher than 42 degrees C above the EVT or 28 degrees C below the flash point or 274 degrees C (maximum) whichever is lower. EVT and flash point temperatures of asphalt in the kettle shall be conspicuously posted on the kettle. Heating kettle shall be provided with automatic thermostatic control and an accurate thermometer. Kettle operators shall be in attendance at all times during the heating to ensure that the maximum temperature specified is not exceeded. An asphalt tanker shall be treated as a kettle.

3.7 BITUMEN APPLICATION

Asphalt shall be applied within 14 degrees C below or above the EVT, or 204 degrees C, whichever is higher. Application temperatures shall be measured at the mop bucket or mechanical applicator. Bitumen at a temperature below the recommended temperature shall be returned to the kettle.

3.8 APPLICATIONS OF BASE SHEET

Base sheet shall be applied, shingle fashion, in a continuous operation, with side laps in accordance with manufacturer's printed instructions. End laps shall be not less than 150 mm and staggered a minimum of 600 mm. Base sheets shall be applied at right angles to the slope (except on curved or steep deck) and laps shall face down the slope. Venting base sheet shall be mechanically fastened in conformance with requirements of FM P7825c and the manufacturer's printed instructions.

3.9 MODIFIED BITUMEN MEMBRANE APPLICATION

Membrane shall be two plies, as recommended by the membrane manufacturer. Each sheet in each ply shall be fully adhered to the underlying surface. Sheet edges shall lie flat, with no fishmouths or wrinkles. Installation shall begin at the low point of the roof and progress to the high point with each sheet installed shingle fashion. Each sheet shall be unrolled to provide 100 mm side laps and 150 mm end laps. End laps shall be staggered not less than 600 mm. Laps shall not coincide with laps of base layers except at lines of permanent termination. Sheets shall be embedded in hot solid-mopped asphalt, applied at a rate of 0.97 to 1.46 kg per square meter. Hot asphalt shall flow out of all side and end laps. End laps shall be back-mopped.

3.10 TERMINATIONS AT PERIMETERS

The modified bitumen membrane shall extend up abutting surface at least 100 mm or 50 mm above the top of the cant.

3.11 MECHANICAL FASTENING

Nails and fasteners for securing base or membrane sheet to wood nailers or deck shall be flush driven through flat metal disks of not less than 25 mm diameter. Metal disks may be omitted where heads of fasteners are equivalent in size to the 25 mm diameter disks. Screw fasteners with disks as specified by the membrane manufacturer shall be used on concrete or metal deck. Nails and fasteners shall be spaced to meet the wind uplift requirement and within the tolerances specified by the manufacturer. Penetration of nails and fasteners will not be permitted through the exposed surface of membrane.

3.12 PROTECTION OF APPLIED ROOFING

At end of day's work or whenever precipitation is imminent, the terminated edge of the roofing shall be sealed with two full width strips of roofing felt set in and coated with bituminous cement or hot mopped asphalt. One half-width of strips shall be extended up and over the finished roofing and the other half-width extended out and onto the bare roof deck or existing membrane. Sealing strips shall be removed before continuing installation of roofing. To facilitate sealing, termination edges may be straightened with pieces of insulation board which shall be removed when work is resumed.

3.13 FLASHINGS

Flashings shall be provided over cants, in the angles formed at walls and other vertical surfaces, and where required to make the work watertight. Modified bitumen flashings shall be used, except where metal flashings are specified in other sections of the specifications.

3.14 WALKWAYS

Walkways shall be back-mopped and embedded in the flood coat and shall be located as indicated.

3.15 NOT USED

3.16 NOT USED

3.17 NOT USED

3.18 NOT USED

3.19 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roofing with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Inspection shall include, but not be limited to, the following:

*** SAFETY PAYS ***

a. Observation of environmental conditions; number and skill level of roofing workers; start and end time of various tasks; condition of substrate.

b. Verification of compliance of materials before, during, and after installation.

c. Inspection of condition of equipment and accuracy of thermometers and metering devices.

d. Inspection of flashings, cants and curbs.

e. Inspection of membrane placement, including edge envelopes, widths of starter sheets, laps, proper use of squeegee, and mechanical fastening.

f. Inspection of application of bitumen, aggregate, and walkways.

g. Cutout sampling and analysis as directed.

End of Section

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 07535
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
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		1	Modified Bitumen roof layout; GA.										
			SD-06 Instructions										
		2	Materials and Installation; FIO.										
			SD-13 Certificates										
		3	Qualifications; FIO.										
		4	Materials; FIO.										
			SD-18 Records										
		5	Bills of Lading; FIO.										

***** SAFETY PAYS *****

SECTION 07600

SHEET METALWORK, GENERAL
10/94

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SECTION 07600

SHEET METALWORK, GENERAL
10/94

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1996) Stainless and Heat-Resisting Chromium -Nickel Steel Plate, Sheet, and Strip
ASTM B 32	(1996) Solder Metal
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM B 370	(1992) Copper Sheet and Strip for Building Construction
ASTM D 226	(1997) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 1784	(1996) Rigid Poly(Vinyl Chloride)(PVC) Compounds and Chlorinated Poly(Vinyl Chloride)(CPVC) Compounds
ASTM D 2822	(1991; R 1997) Asphalt Roof Cement
ASTM D 4022	(1994) Coal Roof Cement, Asbestos Containing
ASTM D 4586	(1993) Asphalt Roof Cement, Asbestos Free

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION(SMACNA)

SMACNA-02	(1993) Architectural Sheet Metal Manual

1.2 GENERAL REQUIREMENTS

Sheet metalwork shall be accomplished to form weathertight construction without waves, warps, buckles, fastening stresses or distortion, and shall allow for expansion and contraction.

1.2.1 Coordination

Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics. Exposed edges shall be hemmed. Bottom edges of exposed vertical surfaces shall be angled to form drip. Flashing at end of a run shall be formed into a three dimensional configuration to direct water to the outside of the system. Joints shall be installed as specified in TABLE III. Accessories and other items essential to complete the sheet metal installation, though not specifically indicated or specified, shall be provided. Installation of sheet metal items used in conjunction with roofing shall be coordinated with roofing work to permit continuous roofing operations. Factory-fabricated components shall be packed in cartons marked with the manufacturer's name or trademark. Bulk materials from which items are field fabricated shall have manufacturer's name or trademark printed or embossed at frequent intervals to permit easy identification. Sheet metalwork pertaining to heating, ventilating, and air conditioning is specified in other sections.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Materials; FIO.

Drawings of sheet metal items showing weights, gauges or thickness; types of materials; joining, expansion-joint spacing; fabrication details; and installation procedures. Materials shall not be delivered to the site until after the approved detail drawings have been returned to the contractor.

SD-08 Statements

Contractor Quality Control; GA.

Quality Assurance Plan, including a checklist of points to be observed, prior to start of roofing and metal panel work.

SD-14 Samples

Materials; FIO.

Samples of materials proposed for use, upon request.

1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage,

dampness, and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the requirements specified below and those given in TABLE I. Where TABLE I lists more than one metal for a particular item, any listed metal may be used unless otherwise specified. Different items need not be of same metal, except that exposed sheet metal shall be stainless steel.

2.1.1 Accessories

Accessories and other items essential to complete the sheet metal installation, though not specifically indicated or specified, shall be provided.

2.1.2 Aluminum Extrusions

ASTM B 221, Alloy 6063, Temper T5.

2.1.3 Bituminous Cement

Type I asphalt cement conforming to ASTM D 2822 or ASTM D 4586. For coal tar roofing; coal tar cement conforming to ASTM D 4022.

2.1.4 Sealant

Unless otherwise specified, sealant shall be an elastomeric weather resistant sealant as specified in Section 07920 CAULKING AND SEALANTS.

2.1.5 Fasteners

Materials shall conform to TABLE II. Fasteners shall be the type best suited for the application.

2.1.6 Felt

ASTM D 226, Type I.

2.1.7 Polyvinyl Chloride (PVC) Reglets

ASTM D 1784.

2.1.8 Aluminum Alloy Sheet and Plate

ASTM B 209, form, alloy, and temper appropriate for use.

2.1.9 Copper

ASTM B 370, Temper H 00.

2.1.10 Stainless Steel

Corrosion-resisting steel, hereinafter referred to as "stainless steel"; ASTM A 167, Type 302 or 304; fully annealed, dead soft temper.

2.1.11 Solder

ASTM B 32, 95-5 tin-antimony.

2.1.12 Copper Clad Stainless Steel

ASTM 506, Type 409 core. Thickness of copper on each side shall be 10% of total thickness.

2.1.13 Through-Wall Flashing

Flashing shall be copper, copper-clad stainless steel or stainless steel having factory-formed deformations providing mechanical bond in mortar joints. Minimum metal thickness shall be as shown in TABLE I.

2.1.14 Soffit Vent

Continuous 100 mm 24 ga., metal louvered soffit vent with insect screen. Color to match cornice.

2.1.15 Relief Vent

Roof mounted painted aluminum gravity ventilator with birdscreen and aluminum curb. Vent unit shall have a throat area of 5160 square mm with throat size of 610 by 1220 mm. Unit shall be Fabra Hood FHR 24 x 48 or approved equal. Color to match roof panels.

2.1.16 Gutter Coordination With Steel Panels

Selection of material,color and finish of the gutter, downspout, straps and other related gutter accessories shall be coordinated with specification SECTION 07412 NON-STRUCTURAL METAL ROOFING. Gutter material, color, and finish shall also be coordinated with specification Section 07413 METAL SIDING, FACTORY-COLOR-FINISH. The Barracks (Building 7039) gutter shall be constructed in accordance with SMACNA figure 1-15A.

PART 3 EXECUTION

3.1 GENERAL

Items such as gutters, downspouts and louvers shall be fabricated in conformance with SMACNA-02 and as indicated. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 13 mm hem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing.

3.2 EXPANSION JOINTS

Expansion joints shall be provided at 12.0 meter intervals for copper, aluminum and stainless steel, except extruded aluminum gravel stops and fascia which shall have expansion joints at not more than 3.6 meter spacing. Joints shall be evenly spaced. An additional joint shall be provided where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing.

3.3 PROTECTION OF ALUMINUM

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods:

3.3.1 Paint

Aluminum surfaces shall be solvent cleaned and given one coat of zinc-molybdate primer and one coat of aluminum paint as specified in Section 09900 PAINTING, GENERAL.

3.3.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and cemented to the aluminum surface using a cement compatible with aluminum.

3.4 CONNECTIONS AND JOINTING

3.4.1 Soldering

Soldering shall apply to copper, copper clad stainless steel and stainless steel items. Edges of sheet metal shall be pretinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water.

3.4.2 Riveting and Sealing

Joints in aluminum sheets 1.0 mm or less in thickness shall be mechanically made and sealed with the sealant specified.

3.4.3 Seaming

Flat-lock and soldered-lap seams shall finish not less than 25 mm wide. Unsoldered plain-lap seams shall lap not less than 75 mm unless otherwise specified. Flat seams shall be made in the direction of the flow.

3.5 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork.

Butt joints of cleats shall be spaced approximately 3 mm apart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 300 mm on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry. The cleat for fascia anchorage shall be installed to extend below the supporting construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm. The cleat shall be of sufficient width to provide adequate bearing area to insure a rigid installation. Where horizontal nailer is vented for insulation and the cleat is placed over masonry or concrete, the cleat shall be installed over 1.5 mm thick metal washers placed at screws. Washers shall be of metal that is electrolytically compatible with the continuous cleat.

3.6 GUTTERS AND DOWNSPOUTS

Gutters shall terminate at least 13 mm away from vertical surfaces. Supporting brackets shall be anchored in manner compatible with roofing. Gutters shall be hung with high points at ends or equal distant from downspouts and shall have a slope of not less than 1.6 mm per 300 mm. Downspouts shall be set plumb and not less than 25 mm from the wall. Leaders shall connect gutters on overhanging eaves to downspouts. Leaders shall be set with a slope not less than 1.6 mm per 300 mm or more than 30 degrees below a horizontal line. Leaders shall fit over the outlet tube in gutter bottom and shall fit into and be riveted to the downspout. Rivet spacing shall be not more than 50 mm. Strainers shall be set loosely in the eave tube opening in the gutter. Joints between lengths of downspouts shall be made by telescoping the end of the upper lengths at least 19 mm into the lower length. Downspouts terminating in drainage lines shall be neatly fitted into downspout boots and the joint filled with a cement mortar cap sloped away from the downspout. Downspout hangers shall be provided adjacent to the joint at the top of each section of downspout. Hangers shall be 1.6 mm by 25 mm flat stock of the same material as the downspout.

3.7 FLASHINGS

Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof, and floor drains, and for electrical conduit projections through roof or walls are specified in other sections. Cap flashing shall be turned around exterior corners of masonry or concrete walls at least 50 mm, shall be secured into masonry joints and into concrete with expansion anchors and sealed with No. 2 or 4 sealing compound. Cap and base flashing for exterior and interior corners shall be factory-fabricated units. Corner units shall have mitered joints, shall be installed with 75 mm lap joint over flashing on each side. Unless otherwise indicated, through wall flashing shall be terminated 13 mm inside each exposed face of the wall. Except as otherwise indicated, cap flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be covered up by an application of bituminous plastic cement at the perforation. Flashing shall be installed on top of joint reinforcement. Flashing shall be formed to direct water to the outside of the system.

3.7.1 Base Flashing

Base flashing shall extend out on the roof or horizontal surface not less than 100 mm. Metal base flashing shall be installed at locations indicated and shall be coordinated with roofing work. Metal base flashing shall be set in plastic bituminous cement over the roofing membrane, nailed to nailing strip, and secured in place on the roof side with nails spaced not more than 75 mm on centers.

3.7.2 Cap Flashings

Cap flashing shall be installed either in a reglet specified in paragraph "REGLETS" or shall consist of a two-piece combination unit with the receiver component built in the construction and the cap component interlocking not

less than 38 mm into the receiver. The flange of the receiver component installed into masonry shall extend not less than 100 mm into the joint. Flange shall be located not less than 203 mm nor more than 405 mm above roofing not having cant strips or shall be located not less than 127 mm nor more than 330 mm above cant strip. Cap flashing shall overlap metal base flashing not less than 76 mm and when used with reglets shall extend into reglets not less than 28 mm. Where bituminous base flashings are provided, the cap flashing shall extend down as close as practical to the top of the cant strip. Cap flashing shall be factory formed to provide spring action against the base flashing. Lower edge shall have a longitudinal V-type crimp or shall be folded under not less than 13 mm. Cap flashing terminations shall be sealed.

3.7.3 Through-Wall Flashing

Through-wall flashing includes sill, lintel, and spandrel flashing. The flashing shall be laid with a layer of mortar above and below the flashing so that the total thickness of the two layers of the mortar and flashing are the same thickness as the regular mortar joints. Flashing shall not extend further into the masonry backup wall than the first mortar joint. Joints in flashing shall be lapped and sealed. Flashing shall be one piece for lintels and sills. Flashing arc to have drips and end dams.

3.7.3.1 Lintel Flashing

Lintel flashing shall extend the full length of lintel. Flashing shall extend through the wall one masonry course above the lintels and shall be bent down over the vertical leg of the outer steel lintel angle not less than 50 mm, or shall be applied over top of masonry and precast concrete lintels. Bed joints of lintels at control joints shall be underlaid with sheet metal bond breaker.

3.7.3.2 Sill Flashing

Sill flashing shall extend the full width of the sill and not less than 100 mm beyond ends of sill except at control joint where the flashing shall be terminated at the end of the sill.

3.8 INSTALLATION OF LOUVERS

Louvers shall be rigidly attached to the supporting construction. The installation shall be rain-tight. Louver screen shall be installed as indicated.

3.9 REGLETS

Reglets shall be a factory fabricated product of proven design, complete with fittings and special shapes as required. Open-type reglets shall be filled with fiberboard or other suitable separator to prevent crushing of the slot during installation. Reglets shall be located not less than 203 mm nor more than 405 mm above roofing not having cant strips or shall be located not less than 127 mm nor more than 330 mm above cant strip. Reglet plugs shall be spaced not over 300 mm on centers and reglet grooves shall be filled with sealant. Friction or slot-type reglets shall have metal flashings inserted the full depth of slot and shall be lightly punched every 300 mm to crimp the reglet and counter flashing together. Polyvinyl chloride reglets shall be sealed with the manufacturer's recommended sealant.

3.10 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure for sheet metal used in conjunction with

roofing to assure compliance of the installed sheet metalwork with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.

b. Verification of compliance of materials before, during, and after installation.

c. Inspection of sheet metalwork for proper size and thickness, fastening and joining, and proper installation.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer at the end of each day.

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES

Sheet Metal Items	Copper, kilograms Per Square meter	Aluminum, mm	Stainless Steel, mm	Terne-Coated Stainless Steel, mm	Zinc-Coated Steel, mm
Building Expansion Joints Cover.....	4.9	0.81	0.38	0.38	0.6
Waterstop-bellows or flanged, U-type.....	4.9	-	0.38	0.38	-
Covering on minor flat, pitched or curved surfaces.....	6.125	1.02	0.46	0.46	-
Downspouts and leaders.....	4.9	0.81	0.38	0.38	0.6
Downspout clips and anchors.....	-	1.02 clip	-	-	-
	-	3.175 anchor	-	-	-
Downspout straps, 50 mm.....	14.7(a)	1.52	1.27	-	-
Conductor heads.....	4.9	0.81	0.38	0.38	-
Scupper lining.....	6.125	0.81	0.38	0.38	-
Strainers, wire diameter or gage....	4.0 gage	3.66 diameter	2.77 diameter	-	-
Flashings:					
Thru-wall	4.9		0.38	0.38	-
Base.....	6.125	1.02	0.46	0.46	0.6
Cap (Counter-flashing)	4.9	0.81	0.38	0.38	0.5
Eave.....	4.9	-	0.38	0.38	0.6
Spandrel beam.....	3.1	-	0.38	0.38	-

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES (Cont'd)

Sheet Metal Items	Copper, kilograms Per Square meter	Stainless Aluminum, mm	Terne-Coated Stainless Steel, mm	Zinc-Coated Steel, Steel, mm	mm
Bond barrier.....	4.9	-	0.38	0.38	-
Stepped.....	4.9	0.81	0.38	0.38	-
Valley.....	4.9	0.81	0.38	0.38	-
Roof drain.....	4.9(b)				
Pipe vent sleeve(d)					
Coping.....	4.9	-	-	-	-
Gravel stops and fascias:					
Extrusions.....	-	1.91	-	-	-
Sheets,					
corrugated.....	4.9	0.81	0.38	0.38	-
Sheets, smooth.....	6.125	1.27	0.46	0.46	0.6
Edge strip.....	7.35	1.27	0.635	-	-
Gutters:					
Gutter section.....	4.9	0.81	0.38	0.38	0.6
Continuous cleat.....	4.9	0.81	0.38	0.38	0.6
Hangers, dimensions.....	25 mm x 3 mm (a)	25 mm x 2 mm (c)	25 mm x one mm	-	-
Joint Cover plates... (See Table III)	4.9	0.81	0.38	0.38	0.6
Reglets (c).....	3.1	-	0.38	0.38	-
Splash pans.....	4.9	1.02	0.46	0.46	-

(a) Brass.

(b) May be lead weighing 19.6 kilograms per square meter.

(c) 12.25 kilogram minimum lead sleeve with 100 mm flange. Where lead sleeve is impractical, refer to paragraph entitled "Single Pipe Vent" for optional material.

TABLE II. FASTENER MATERIALS

To prevent corrosion, the indicated fastener materials shall be used with the following sheet metals:

Sheet Metal	Nails	Screws	Rivets	Bolts
Aluminum	Aluminum	Aluminum	Aluminum	Aluminum
Copper	Copper	Bronze	Copper	Bronze
Copper Clad Stainless Steel	Copper or Stainless Steel	Bronze or Stainless Steel	Bronze or Stainless Steel	Bronze or Stainless Steel
Lead Coated Copper	Copper	Bronze	Bronze	Bronze
Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel

TABLE III. SHEET METAL JOINTS

Item Designation	TYPE OF JOINT: Copper, Terne-Coated Stainless Steel, Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks
Joint cap for building expansion joint at roof	30 mm single lock, standing seam, cleated	30 mm single lock, standing seam, cleated	- - -
Flashings:			
Base	25 mm 75 mm lap for expansion joint	25 mm flat locked, soldered; sealed; 75 mm lap for expansion joint	Aluminum producer's recommended hard setting sealant locked aluminum joints. Fill each metal expansion joint with a joint sealing compound compound. See Section 07920, CAULKING AND SEALANTS.
Cap-in reglet	75 mm lap	75 mm lap	Seal groove with joint sealing compound. See Section 07920, CAULKING AND SEALANTS.

TABLE III. SHEET METAL JOINTS (Cont'd)

TYPE OF JOINT

Item Designation	Copper, Terne-Coated Stainless Steel, Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks
Reglets	Butt joint	- - -	Seal reglet groove with joint sealing compound. See Section 07920, CAULKING AND SEALANTS.
Eave	25 mm flat locked, cleated. 25 mm loose locked, sealed expansion joint, cleated	25 mm flat locked, locked, cleated 25 mm loose locked, sealed expansion joints, cleated	Same as base flashing.
Stepped	75 mm lap	75 mm lap	- - -
Valley.	150 mm lap cleated	150 mm lap cleated	- - -
Edge strip	Butt	Butt	- - -
Gravel stops:			
Extrusions	- - -	Butt with 13 mm space	Use sheet flashing beneath and a cover plate.
Sheet, smooth	Butt with 6 mm space	Butt with 6 mm space	Use sheet flashing backup plate.
Sheet corru-	Butt with 6 mm space	Butt with 6 mm space	Use sheet flashing beneath and a gated cover plate or a combination unit

Gutters	40 mm lap, riveted and soldered	25 mm flat locked, riveted, and sealed	Aluminum producers recommended hard setting sealant for locked aluminum joints.

(a) Elastomeric flashing shall have 75 mm lap with manufacturer's recommended sealant.

(b) Polyvinyl chloride reglet shall be sealed with manufacturer's recommended sealant.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 07600
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-04 Drawings										
		1	Materials; FIO.										
			SD-08 Statements										
		2	Contractor Quality Control; GA.										
			SD-14 Samples										
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SECTION 07920

CAULKING AND SEALANTS
04/96

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*** SAFETY PAYS ***

SECTION 07920

CAULKING AND SEALANTS
04/96

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 570	(1995) Oil- and Resin-Base Caulking Compound for Building Construction
ASTM C 734	(1993) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C 834	(1995) Latex Sealants
ASTM C 920	(1994) Elastomeric Joint Sealants
ASTM D 217	(1994) Cone Penetration of Lubricating Grease
ASTM D 1056	(1991) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM E 84	(1996a) Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Backing; FIO.

Bond-Breaker; FIO.

Sealant; FIO.

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). A copy of the Material Safety Data Sheet shall be provided for each solvent, primer or sealant material.

SD-13 Certificates

Sealant; GA.

Certificates of compliance stating that the materials conform to the specified requirements. Certificates shall

include laboratory test reports showing that the caulking and sealants have been tested within the last 12 months.

SD-14 Samples

Materials; FIO.

Five cartridges or 2 quarts of each caulking and sealant specified herein. The sample containers shall include the same information on the label as specified herein for containers delivered to the job.

1.3 GENERAL REQUIREMENTS

Caulking and sealants shall be provided in joints as indicated or specified. The joint design, shape, and spacing shall be as indicated. Mixing shall be in accordance with instructions provided by the manufacturer of the sealants.

1.4 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 4 to 32 degrees C when the caulking and sealants are applied.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. The containers shall include the following information on the label: manufacturer, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time when applicable at the standard conditions for laboratory tests. Caulking compound or components outdated as indicated by shelf life shall not be used. Materials shall be carefully handled and stored to prevent inclusion of foreign materials or exposure to temperatures between 4 and 32 degrees C unless otherwise specified by the manufacturer. Sealant tape shall be handled and stored in a manner that will not deform the tape.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the respective specifications and other requirements specified. Each container brought to the jobsite with a different sealant formulation shall be marked for the intended use. For each intended use, the color shall be one of the manufacturer's standard colors as selected by the Contracting Officer.

2.2 BACKING

Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated.

2.2.1 Rubber Backing

Cellular rubber sponge backing A shall be ASTM D 1056, Type 2, closed cell, Class A, round cross section.

2.3 BOND-BREAKER

Bond-breaker shall be as recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.4 PRIMER

Primer shall be non-staining type as recommended by sealant manufacturer for the application. Primer shall have been tested for durability with the sealant to be used and on samples of the surfaces to be sealed.

2.5 CAULKING

Oil and resin-based caulking, (sealant no.1) shall be ASTM C 570, Type 1.

2.6 LATEX SEALANT

Latex Sealant, (sealant no.3) shall be ASTM C 834.

2.7 ELASTOMERIC SEALANTS

Elastomeric sealants shall conform to ASTM C 920 and the following:

a. Polysulfide Sealant : Type S (sealant no.4) or M (sealant no.2), Grade NS (type II, vertical), Class 25 (maximum % of joint movement), Use NT (no traffic), M (mortar), A (aluminum).

b. Polyurethane Sealant : Type S (sealant no.4) or M (sealant no.2), Grade NS (type II, vertical), Class 25 (maximum % of joint movement), Use NT (no traffic), M (mortar), A (aluminum), T (traffic).

c. Silicone Sealant : (sealant no.4) or M (sealant no.2), Grade NS (type II,vertical), Class 25 (maximum % of joint movement), Use NT (no traffic), M (mortar), A (aluminum).

2.8 ACOUSTICAL SEALANT

Rubber or polymer-based acoustical sealant sealant no.11 shall have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84. Acoustical sealant shall have a consistency of 250 to 310 when tested in accordance with ASTM D 217, and shall remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C 734, and shall be non-staining.

2.9 PREFORMED SEALANT

2.9.1 Sealant no. 10

Sealant shall be preformed polyurethane foam strip capable of sealing out moisture, air, and dust, when compressed to the extent recommended by the manufacturer for the capability of the joint. Service temperature shall be minus 40 to plus 275 degrees F. Treated strips shall be saturated with butylene waterproofing or impregnated with asphalt. Untreated strips shall be furnished with adhesive to hold them in place. The cured adhesive shall not stain or bleed into adjacent finishes. The sealant shall be furnished in the proper width to obtain the degree of compression required when installed in the joint.

Preformed sealant shall be polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealant capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus 34 to plus 71 degrees C, the sealant shall be non-bleeding and shall have no loss of adhesion.

2.9.2 Tape Sealant

Tape sealant, sealant no. 6 or 7: cross-section dimensions shall be coordinated with the glazing section.

2.9.3 Bead Sealant

Bead sealant, sealant no. 6 or 7: cross-section dimensions shall be coordinated with the glazing section.

2.9.4 Foam Strip

Foam strip sealant no.10 shall be polyurethane foam; cross-section dimensions shall be coordinate with door

sections. Foam strip shall be capable of sealing out moisture, air, and dust when installed and compressed as recommended by the manufacturer. Service temperature shall be minus 40 to plus 135 degrees C. Untreated strips shall be furnished with adhesive to hold them in place. Adhesive shall not stain or bleed into adjacent finishes. Treated strips shall be saturated with butylene waterproofing or impregnated with asphalt.

2.10 SOLVENTS AND CLEANING AGENTS

Solvents, cleaning agents, and accessory materials shall be provided as recommended by the manufacturer.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Surface Preparation

The surfaces of joints to be sealed shall be dry. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints to be in contact with the sealant. Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths.

3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

3.1.4 Aluminum Surfaces

Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be non-staining.

3.1.5 Wood Surfaces

Wood surfaces to be in contact with sealants shall be free of splinters and sawdust or other loose particles.

3.2 APPLICATION

3.2.1 Masking Tape

Masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

3.2.2 Backing

Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

3.2.3 Bond-Breaker

Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

3.2.4 Primer

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

3.2.5 Sealant

Sealant shall be used before expiration of shelf life. Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Joints shall be sealed as detailed in the drawings. Sealant shall be forced into joints with sufficient pressure to expel air and fill the groove solidly. Sealant shall be installed to the indicated depth without displacing the backing. Unless otherwise indicated, specified, or recommended by the manufacturer, the installed sealant shall be tooled so that the surface is uniformly smooth and free of wrinkles and to assure full adhesion to the sides of the joint. Sealants shall be installed free of air pockets, foreign embedded matter, ridges and sags. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

3.2.5.1 SEALANT USES

Caulking compounds shall be used in various interior joints as follows:

a. Openings 1/4 inch and less between walls and partitions and adjacent lockers, casework, door frames, built-in or surface-mounted equipment and fixtures, etc.

b. Perimeters of frames of doors, windows, and access panels which adjoin exposed interior concrete and masonry surfaces.

c. Joints between interior masonry walls and partitions and columns, pilasters, concrete walls, or exterior walls unless otherwise detailed.

d. Seats of metal thresholds for exterior doors.

e. Joints between metal edge members for acoustical tile and adjoining vertical surfaces.

f. Other interior locations where small voids between materials require filling for first-class workmanship and painting.

Sealing compounds shall be used in various exterior joints as follows:

a. Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealing compound at both exterior and interior surfaces of exterior wall penetrations.

b. Joints between new and existing exterior masonry walls.

c. Masonry joints in which shelf angles occur.

d. Expansion and control joints.

e. Interior face of expansion joints in exterior concrete or masonry walls where no metal expansion joint covers are required.

f. Openings where items pass through exterior walls.

g. Metal reglets when lead caulking rope is not used, where flashing is inserted into masonry joints, or where flashing is penetrated by coping dowels.

h. Metal-to-metal joints where sealing or caulking is shown or specified.

i. Joints occurring between ends of gravel stops, fasciae and/or copings and adjacent walls.

j. Bottoms of exterior doorway frames.

k. Decks and walkways.

The sealant(s)to be used in the various joints indicated shall be as follows:

Joint Symbol	Sealant No.
IPAG	2 or 4
MJE	2 or 4
MJF	2 or 4
MJA	2 or 4
MJAB	2 or 4
MJG	10
MJH	10
MJI	2 or 4
MJK	2 or 4
MJM	2 or 4
MJN	2 or 4 (exterior)
	10 (interior)
MJO	2 or 4
MJP	2 or 4
PAG	2 or 4
TJB	2 or 4
TJD	2 or 4
TJE	2 or 4

3.3 CLEANING

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealant application as work progresses.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 07920
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO.	TRANS-MITTAL NO.	ITEM NO.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER	REV-IEW-ER	SUBMIT	APPROV. NEEDED BY	MATER. NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
a.	b.	c.	d. through q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
			PAR. NO. SD-01 Data										
		1	Backing; FIO.										
		2	Bond-Breaker; FIO.										
		3	Sealant; FIO.										
			SD-13 Certificates										
		4	Sealant; GA.										
			SD-14 Samples										
		5	Materials; FIO.										

***** SAFETY PAYS *****

SECTION 08110

STEEL DOORS AND FRAMES
02/95

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1.2 SUBMITTALS 08110-2
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*** SAFETY PAYS ***

SECTION 08110

STEEL DOORS AND FRAMES
02/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 236	(1989; R 1993) Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
ASTM C 976	(1990) Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box
ASTM D 2863	(1991) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
ASTM E 90	(1990) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
ASTM E 283	(1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen

DOOR AND HARDWARE INSTITUTE (DHI)

DHI-A115.IG	(1994) Installation Guide for Doors and Hardware

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA 862	(1987) Hollow Metal Manual; Section: Guide Specifications for Commercial Security Hollow Metal Doors and Frames
NAAMM HMMA 865	(1992) Hollow Metal Manual; Section: Guide Specifications for Swinging Sound Control Hollow Metal Doors and Frames

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1995) Fire Doors and Windows
NFPA 80A	(1997) Protection of Buildings from Exterior Fire Exposures
NFPA 101	(1994) Safety to Life from Fire in Buildings

and Structures

NFPA 252 (1995) Fire Tests of Door Assemblies

STEEL DOOR INSTITUTE (SDOI)

SDOI SDI-100 (1991) Standard Steel Doors and Frames

SDOI SDI-106 (1996) Standard Door Type Nomenclature

SDOI SDI-107 (1984) Hardware on Steel Doors (Reinforcement - Application)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Steel Doors and Frames; FIO.

Drawings using standard door type nomenclature in accordance with SDOI SDI-106 indicating the location of each door and frame, elevation of each model of door and frame, details of construction, method of assembling sections, location and extent of hardware reinforcement, hardware locations, type and location of anchors for frames, and thicknesses of metal. Drawings shall include catalog cuts or descriptive data for the doors, frames, and weatherstripping including air infiltration data and manufacturers printed instructions.

SD-09 Reports

Fire Rated Doors; FIO.

A letter by a nationally recognized testing laboratory which identifies the product manufacturer, type, and model; certifying that the laboratory has tested a sample assembly in accordance with ASTM E 152 and issued a current listing for same.

SD-13 Certificates

Fire Rated Doors; FIO.

Thermal Insulated Doors; FIO.

a. Certification of Thermal Insulating Rating: Certification or test report for thermal insulated doors shall show compliance with the specified requirements. The certification, or test report, shall list the parameters and the type of hardware and perimeter seals used to achieve the rating.

1.3 DELIVERY AND STORAGE

During shipment, welded unit type frames shall be strapped together in pairs with heads at opposite ends or shall be provided with temporary steel spreaders at the bottom of each frame; and knockdown type frames shall be securely strapped in bundles. Materials shall be delivered to the site in undamaged condition, and stored out of contact with the ground and under a weathertight covering permitting air circulation. Doors and assembled frames shall be stored in an upright position in accordance with DHI-A115.IG. Abraded, scarred, or rusty areas shall be cleaned and touched up with matching finishes.

1.4 WARRANTY

Manufacturer’s standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

Doors and frames shall be factory fabricated in accordance with SDOI SDI-100 and the additional requirements specified herein. Door and frame grade shall be extra heavy duty Grade III (14 gauge frame and 16 gauge door) unless otherwise indicated on the door and door frame schedules. Exterior doors and frames shall be galvanized. Doors and frames shall be prepared to receive hardware conforming to the templates and information provided under Section 08700 BUILDERS' HARDWARE. Doors and frames shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, and flush bolts as required. Doors and frames shall be reinforced for surface applied hardware. Frames shall be welded type. Door frames shall be furnished with a minimum of three jamb anchors and one floor anchor per jamb. Anchors shall be not less than 1.2 mm steel or 4.5 mm diameter wire. For wall conditions that do not allow the use of a floor anchor, an additional jamb anchor shall be provided. Rubber silencers shall be furnished for installation into factory predrilled holes in door frames; adhesively applied silencers are not acceptable. Where frames are installed in plaster or masonry walls, plaster guards shall be provided on door frames at hinges and strikes. Full glass doors shall conform to SDOI SDI-100, Model 3, and shall include provisions for glazing. Reinforcing of door assemblies for closers and other required hardware shall be in accordance with SDOI SDI-100 and the conditions of the fire door assembly listing when applicable. Exterior doors shall have top edges closed flush and sealed against water penetration.

2.2 FIRE RATED DOORS

Fire rated door assemblies shall bear the listing identification label of a nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with ASTM E 152 and having a listing for the tested assemblies. The fire resistance rating shall be as shown. Doors exceeding the sizes for which listing label service is offered shall be in accordance with ASTM E 152. Listing identification labels shall be constructed and permanently applied by a method which results in their destruction should they be removed.

2.3 THERMAL INSULATED DOORS

The interior of thermal insulated doors shall be completely filled with rigid plastic foam permanently bonded to each face panel. The thermal conductance (U-value) through the door shall not exceed 2.33 W/sq m times K when tested as an operational assembly in accordance with ASTM C 236 or ASTM C 976. Doors with cellular plastic cores shall have a minimum oxygen index rating of 22 percent when tested in accordance with ASTM D 2863.

2.4 WEATHERSTRIPPING

Weatherstripping for head and jamb shall be manufacturer's standard elastomeric type of synthetic rubber, vinyl, or neoprene and shall be installed at the factory or on the jobsite in accordance with the door frame manufacturer's recommendations. Weatherstripping for bottom of doors shall be as shown. Air leakage rate of weatherstripping shall not exceed 0.31 l/s per linear meter of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.5 LOUVERS

Where indicated, doors shall be provided with full louvers. Louvers shall be sightproof type inserted into the door. Louvers shall be stationary. Louvers shall be nonremovable from the outside of exterior doors or the unsecure side of interior doors. Insect screens shall be a removable type with 18 by 16 mesh aluminum or bronze cloth. Full louver doors shall be in accordance with SDOI SDI-100, Grade III, Model 3.

2.6 GLAZING

Glazing shall be as specified in Section 08810 GLASS AND GLAZING. Removable glazing beads shall be screw-on or snap-on type.

2.7 FACTORY FINISH

Interior doors and frames shall be phosphatized and primed with standard factory primer system.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with DHI-A115.IG. Preparation for surface applied hardware shall be in accordance with SDOI SDI-107. Rubber silencers shall be installed in door frames after finish painting has been completed; adhesively applied silencers are not acceptable. Weatherstripping shall be installed at exterior door openings to provide a weathertight installation. Installation and operational characteristics of fire doors shall be in accordance with NFPA 80, NFPA 80A and NFPA 101. Hollow metal door frames shall be solid grouted in masonry walls.

3.1.1 Thermal Insulated Doors

Hardware and perimeter seals shall be adjusted for proper operation. Doors shall be sealed weathertight after installation of hardware and shall be in accordance with Section 07920 CAULKING AND SEALANTS.

3.2 FIELD PAINTED FINISH

Steel doors and frames shall be field painted in accordance with Section 09900 PAINTING, GENERAL. Weatherstrips shall be protected from paint. Finish shall be free of scratches or other blemishes. Color shall be as shown on the finish schedule.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 08110
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-04 Drawings										
		1	Steel Doors and Frames; FIO.										
			SD-09 Reports										
		2	Fire Rated Doors; FIO.										
			SD-13 Certificates										
		3	Fire Rated Doors; FIO.										
		4	Thermal Insulated Doors; FIO.										

***** SAFETY PAYS *****

SECTION 08120

ALUMINUM DOORS AND FRAMES
03/94

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1.2 SYSTEM DESCRIPTION 08120-1
1.3 PERFORMANCE REQUIREMENTS 08120-1
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2.3 FABRICATION OF ALUMINUM DOORS 08120-4

PART 3 EXECUTION 08120-4
3.1 INSTALLATION OF DOORS, FRAMES, AND ACCESSORIES 08120-4

*** SAFETY PAYS ***

SECTION 08120

ALUMINUM DOORS AND FRAMES
03/94

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(1980; R 1993) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 1503.1	(1988) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM E 283	(1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 330	(1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

1.2 SYSTEM DESCRIPTION

Swing-type aluminum doors and frames, of size and design shown on the drawings, shall be provided at the locations indicated. Doors shall be furnished complete with frames, subframes, adjoining sidelights, trim, and other accessories indicated and specified.

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Vertical Rail Rotational Performance

Full-glazed doors, except doors with top and bottom rails fastened together with tensioned tie rods, shall pass the following test:

The test section shall consist of an assembly of the top corner of the door. The side-rail section shall be 609.6 mm long and the top-rail section shall be 304.8 mm long. The top-rail section of doors having tie rods extending between stiles shall have blocking at the section cut to provide anchorage for the tie rod. The top-rail section shall be anchored to the test bench so that the corner protrudes far enough to allow clearance for deflection of the side rail. A lever arm capable of supporting 845 N shall be attached to the side-rail section at a point 482.6 mm from

the inside edge of the top-rail. Position of the lever arm shall be parallel to the top-rail section. A weight support pad shall be attached to the lever arm at a point 482.6 mm from the inner edge of the side rail. The test section shall withstand a load of 578 N on the lever arm before reaching the point of failure. Failure is defined as a joint separation of 1.6 mm during test loading or a vertical rail rotational displacement of 3-1/2 degrees during test loading.

1.3.2 Wind Load Performance

Doors shall be of sufficient strength to withstand a design wind load of 1440 Pa of supported area with a deflection of not more than 1/175 times the length of the member. Doors shall be tested in accordance with ASTM E 330 at a pressure not less than 1.5 times the design load.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Aluminum Doors and Frames; GA.

A schedule showing the location of each door shall be included with the drawings. Drawings showing elevations of each door and frame type, details and method of anchorage, details of construction, location and installation of hardware, shape and thickness of materials, and details of joints and connections.

SD-09 Reports

Full-Glazed and Flushed Doors; GA.

For full-glazed doors, certified test reports stating that doors meet all test and specified requirements. Test shall be conducted by an independent testing laboratory within a period of 36 months preceding delivery of the doors to the site.

SD-14 Samples

Finishes; GA.

Samples of the colored anodized coating, showing the extreme color range.

1.5 DELIVERY AND STORAGE

Materials delivered to the jobsite shall be inspected for damage, and shall be unloaded with a minimum of handling. Storage shall be in a dry location with adequate ventilation, free from dust, water, and other contaminants, and which permits easy access for inspecting and handling. Materials shall be neatly stored on the floor, properly stacked on nonabsorptive strips or wood platforms. Doors and frames shall not be covered with tarps, polyethylene film, or similar coverings.

1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

PART 2 PRODUCTS

2.1 ALUMINUM DOORS AND FRAMES

Extrusions shall comply with ASTM B 221, Alloy 6063-T5. Aluminum sheets and strips shall comply with ASTM B 209, alloy and temper best suited for the purpose. Fasteners shall be hard aluminum or stainless steel.

2.1.1 Finishes

Finish shall be color anodized. Color anodized finish shall be AA-M10C22A42 in accordance with the requirements of AA DAF-45. Finish color shall be dark bronze and shall match in appearance or fall within the two extremes of color range of the approved samples.

2.1.2 Welding and Fastening

Where possible, welds shall be located on unexposed surfaces. Welds required on exposed surfaces shall be smoothly dressed. Welding shall produce a uniform texture and color in the finished work, free of flux and spatter. Exposed screws or bolts will be permitted only at inconspicuous locations and shall have heads countersunk. Concealed reinforcements for hardware shall be welded in place.

2.1.3 Anchors

Anchors shall be stainless steel or steel with a hot-dipped galvanized finish. Anchors of the sizes and shapes required shall be provided for securing aluminum frames to adjacent construction. Anchors shall be placed near top and bottom of each jamb and at intermediate points not more than 625 mm apart. Transom bars shall be anchored at ends, and mullions shall be anchored at head and sill. Vertical mullion reinforcement shall be of sufficient length to extend up to the overhead structural slab or framing and be securely attached thereto. The bottom of each frame shall be anchored to the rough floor construction with 2.4 mm thick stainless steel angle clips secured to the back of each jamb and to floor construction. Stainless steel bolts and expansion rivets shall be used for fastening clip anchors.

2.1.4 Provisions For Hardware

Hardware for aluminum doors is specified in Section 08700 BUILDERS' HARDWARE. Doors and frames shall be cut, reinforced, drilled, and tapped at the factory to receive template hardware. Reinforcement shall be provided in the core of doors as required to receive locks, door closers, and other hardware. Doors to receive surface applied hardware shall be reinforced as required.

2.1.5 Provisions For Glazing

Glazing shall be as specified in Section 08810 GLASS AND GLAZING. Metal glazing beads, vinyl inserts, and glazing gaskets shall be provided for securing glass. Glass stops shall be tamperproof on exterior side.

2.1.6 Weatherstripping

Weatherstripping shall be continuous silicone-treated wool pile type, or a type recommended by the door manufacturer, and shall be provided on head and jamb of exterior doors. Weatherstripping shall be attached to aluminum holders that fit into slots integral with doors or frame stops. Weatherstripping for bottom of doors shall be as shown. Weatherstripping shall be easily replaced without special tools, and shall be adjustable at meeting stiles of pairs of doors. Air leakage rate of weatherstripping shall not exceed 0.775 L/s per lineal meter of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.2 FABRICATION OF ALUMINUM FRAMES

Frames shall be double-glazed and shall have a minimum total average unit thermal resistance of 0.34 square meter degree K per W double-glazed and shall have a minimum condensation resistance factor of 62 in accordance with AAMA 1503.1. Frames shall be fabricated of extruded aluminum shapes to contours as shown on the drawings. Shapes shown are representations of design, function, and required profile. Dimensions shown are

minimum. Shapes of equivalent design may be submitted, subject to approval of samples. Minimum metal wall thickness shall be 2.29 mm, except glazing beads, moldings, and trim shall be not less than 1.27 mm. Frames that are to receive glass shall have removable snap-on glass stops and glazing beads. Joints in frame members shall be milled to a hairline watertight fit, reinforced, and secured mechanically by steel clip arrangement or by screw spline attachment.

2.3 FABRICATION OF ALUMINUM DOORS

2.3.1 Sizes, Clearances, and Edge Treatment

Doors shall be not less than 44.4 mm thick. Clearances shall be 1.6 mm at hinge stiles, 3 mm at lock stiles and top rails, and 5 mm at floors and thresholds. Single-acting doors shall be beveled 3 mm at lock and meeting stile edges.

2.3.1.1 Full-Glazed Stile and Rail Doors

Doors shall have medium stiles and rails as shown, and shall be fabricated from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Doors shall be double-glazed and shall have a minimum total average unit thermal resistance of 0.34 square meter degree K per W. Top and bottom rail shall be fastened together by means of welding or by 10 mm diameter cadmium-plated tensioned steel tie rods. Extruded aluminum snap-in glazing beads shall be provided on interior side of doors. Extruded aluminum theft-proof snap-in glazing beads or fixed glazing beads shall be provided on exterior side of doors. Glazing beads shall have vinyl insert glazing gaskets, designed to receive glass of thickness required. Glass is specified in Section 08810 GLASS AND GLAZING.

PART 3 EXECUTION

3.1 INSTALLATION OF DOORS, FRAMES, AND ACCESSORIES

3.1.1 Protection of Aluminum

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods.

3.1.2 Installation

Frames and framing members shall be accurately set in position to receive doors, and adjoining sidelights. Frames shall be plumb, square, level, and in alignment, and securely anchored to adjacent construction. Metal-to-metal joints between framing members shall be sealed as specified in Section 07920 CAULKING AND SEALANTS. Doors shall be accurately hung with proper clearances, and adjusted to operate properly. Protective coverings if provided shall be removed and the doors and frames shall be thoroughly cleaned.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 08120
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.4 SUBMITTALS										
			SD-04 Drawings										
		1	Aluminum Doors and Frames; GA.										
			SD-09 Reports										
		2	Full-Glazed and Flushed Doors; GA.										
			SD-14 Samples										
		3	Finishes; GA.										

***** SAFETY PAYS *****

SECTION 08210

WOOD DOORS
05/97

PART 1 GENERAL 08210-1
1.1 REFERENCES 08210-1
1.2 GENERAL REQUIREMENTS 08210-1
1.3 SUBMITTALS 08210-2
1.4 STORAGE 08210-2
1.5 HARDWARE 08210-2
1.6 GLAZING 08210-2
1.7 WARRANTY 08210-3

PART 2 PRODUCTS 08210-3
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2.2 FLUSH DOORS 08210-3
2.3 FIRE RATED DOORS 08210-3
2.4 MOULDING AND EDGING 08210-4
2.5 FINISHING 08210-4

PART 3 EXECUTION 08210-4
3.1 INSTALLATION OF DOORS 08210-4

SAFETY PAYS

SECTION 08210

WOOD DOORS
05/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 152	(1981a) Fire Tests of Door Assemblies

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI-02	(1994) Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1995) Fire Doors and Windows
NFPA 101	(1997) Safety to Life from Fire in Buildings and Structures

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)

NWWDA I.S. 1-A	(1993) Architectural Wood Flush Doors

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Doors shall be of the type, size, and design indicated on the drawings, and shall be the standard products of manufacturers regularly engaged in the manufacture of wood doors.

1.2.2 Marking

Each door shall bear a stamp, brand, or other identifying mark indicating quality and construction of the door. The identifying mark or a separate certification shall include identification of the standard on which construction of the door is based, identity of the manufacturing plant, identification of the standard under which preservative treatment, if used, was made, and identification of the doors having a Type I glue bond.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Wood Doors; GA.

Drawings indicating the location of each door, elevation of each type of door, details of construction, marks to be used to identify the doors, and location and extent of hardware blocking. Drawings shall include catalog cuts or descriptive data for doors, weatherstripping, and thresholds to be used.

SD-06 Instructions

Fire Doors; FIO.

Manufacturers preprinted installation and touch-up instructions.

SD-13 Certificates

Fire Rated Doors; FIO.

Certificates for oversize fire doors stating that the doors are identical in design, materials, and construction to a door that has been tested and meets the requirements for the class indicated. Certificates certifying the fire-rating for 20- and 30-minute doors conform to the standards specified. Certificate stating that adhesives used for proposed doors do not contain formaldehyde.

SD-14 Samples

Factory Coated Finish; GA.

Samples of factory applied finish.

1.4 STORAGE

Doors shall be stored in fully covered areas and protected from damage and from extremes in temperature and humidity. Doors shall be stored on supports to prevent warping or twisting, and to provide ventilation. Factory cartons or wrappers shall be kept intact until installation.

1.5 HARDWARE

Hardware, including weatherstripping and thresholds, is specified in Section C-08700 BUILDERS' HARDWARE.

1.6 GLAZING

Glazing is specified in Section 08810 GLASS AND GLAZING.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 GENERAL FABRICATION REQUIREMENTS

2.1.1 Edge Sealing

Wood end-grain exposed at edges of doors shall be sealed prior to shipment.

2.1.2 Adhesives

Adhesives shall be in accordance with NWWDA I.S. 1-A, requirements for Type II Bond Doors (water-repellent) for interior doors. Adhesive for doors to receive a transparent finish shall be nonstaining. Adhesives shall not contain formaldehyde.

2.1.3 Prefitting

Doors shall be furnished prefitted or unfitted at the option of the Contractor.

2.2 FLUSH DOORS

Flush doors shall be solid core and shall conform to NWWDA I.S. 1-A, except for the one year acclimazation requirement in paragraph T-2, which shall not apply. Composite type doors shall be furnished where required to meet fire rating. Wood doors shall be 5-ply or 7-ply construction with faces, stiles, and rails bonded to the cores.

2.2.1 Core Construction

2.2.1.1 Solid Cores

Where not otherwise required by fire rating, door construction shall be glued wood block core or mineral core with vertical and horizontal edges bonded to the core. Blocking and hardware reinforcements for mineral core doors shall be blocking option HB-1-5, HB-2-5, HB-4, HB-5 in accordance with NWWDA I.S. 1-A.

2.2.2 Face Panels

2.2.2.1 Natural Finished Wood Veneer Doors

Veneer doors to receive natural finish shall be Custom Grade, red oak veneer in accordance with NWWDA I.S. 1-A. Vertical stile strips shall be selected to provide edges of the same species and/or color as the face veneer.

2.3 FIRE RATED DOORS

Fire rated door assemblies shall bear the listing identification label of a nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with ASTM E 152 and having a listing for the tested assemblies. The specific time interval rating on the labels shall be 20-, 30-, and 45-minute as shown. Door assemblies shall be in accordance with NFPA 80. Listing identification on labels shall be constructed and permanently applied by a method which results in their destruction should they be removed. Fire rated doors shall be mineral core with 60 or 90 minute rating and staved lumber core with 20, 30 minute rating.

2.3.1 Reinforcement Blocking

Fire rated doors shall be provided, as required, with hardware reinforcement blocking, and top, bottom, and intermediate rail blocking. Lock blocks shall be manufacturer's standard not less than 125 mm by 450 mm. Reinforcement blocking shall be in compliance with the manufacturer's labeling requirements. Reinforcement blocking shall not be of mineral material.

2.3.2 Stile Edges

Composite fire rated doors shall be provided with vertical stile edges that do not contain fire retardant salts. Vertical stiles shall be of the same species and/or color as the face veneer.

2.4 MOULDING AND EDGING

Moulding and edging shall be as shown. Wood species for transparent finished doors shall be compatible with veneer.

2.5 FINISHING

2.5.1 Factory Coated Finish

Doors indicated to receive factory coated finish shall be given a transparent finish conforming to AWI-02 , Section 1500, Custom Grade, medium stain, medium rubbed sheen, open grain effect where indicated on the Finish Schedule. Finish shall be AWI factory finish system Number TR3 or TR4. Color of the stain finish shall be as selected on the finish schedule. Edges of unfitted doors shall be field finished after fitting to the frames.

PART 3 EXECUTION

3.1 INSTALLATION OF DOORS

3.1.1 General Use Doors

Doors shall be fit, hung, and trimmed as required. Door shall have a clearance of 3 mm at the sides and top and shall have a bottom clearance of 6 mm over thresholds and 13 mm at other locations unless otherwise shown. The lock edge or both edges of doors shall be beveled at the rate of 3 mm in 50 mm. Cuts made on the job shall be sealed immediately after cutting, using a clear varnish or sealer. Bottom of doors shall be undercut to allow clear door swing over carpeted areas. Vertical edges of doors which have not been rounded or beveled at the factory shall be eased when the doors are installed.

3.1.2 Fire Doors

SAFETY PAYS

Installation, hardware, and operational characteristics shall conform to NFPA 80 and NFPA 101 and shall be in strict conformance with the manufacturer's printed instructions. Properly sized pilot holes shall be drilled for screws in door edges. Factory applied labels shall remain intact where installed. Labeled hinge stile edge and top edge of door shall not be trimmed. Lockstile edge and bottom edge may be trimmed only to the extent recommended by the door manufacturer.

--END OF SECTION--

SUBMITTAL REGISTER
(ER415-1-10)

CONTRACT NO.

TITLE AND LOCATION

CONTRACTOR

SPEC. SECTION
08210

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-04 Drawings										
		1	Wood Doors; GA.										
			SD-06 Instructions										
		2	Fire Doors; FIO.										
			SD-13 Certificates										
		3	Fire Rated Doors; FIO.										
			SD-14 Samples										
		4	Factory Coated Finish; GA.										

SECTION 08318
SECURITY-VAULT DOOR
03/89

PART 1 GENERAL ..... 08318 -1
1.1 REFERENCES ..... 08318 -1
1.2 GENERAL REQUIREMENTS ..... 08318 -1
1.4 DELIVERY AND STORAGE ..... 08318 -1

PART 2 PRODUCTS ..... 08318 -1
2.1 VAULT DOOR AND FRAME ..... 08318 -1
2.2 DAY GATE ..... 08318 -2
2.3 FACTORY FINISH ..... 08318 -2

PART 3 EXECUTION ..... 08318 -2
3.1 INSTALLATION ..... 08318 -2

SECTION 08318

SECURITY-VAULT DOOR
03/89

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

FEDERAL SPECIFICATIONS (FS)

FS AA-D-600 (Rev C) Door, Vault, Security

1.2 GENERAL REQUIREMENTS

The vault door unit shall be a steel security-vault type door with frame, dutch door type day gate, and ramp type threshold, and shall be a standard product of a manufacturer specializing in this type of fabrication.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTALS:

SD-01 Data

Security Vault Door; GA.

Manufacturer's catalog data including catalog cuts and brochures. The data shall show that the proposed vault door unit conforms with the requirements in FS AA-D-600, and has been tested and approved by the General Services Administration (GSA).

SD-13 Certificates

Security Vault Door; FIO.

Certification shall state that vault-door units that do not bear the GSA label are constructed to Class 5 standards.

1.4 DELIVERY AND STORAGE

Door and frame assemblies shall be delivered to the jobsite in a protective covering with the brand and name clearly marked thereon. Materials delivered to the jobsite shall be inspected for damage, and unloaded with a minimum of handling. Storage shall be in a dry location with adequate ventilation, free from dust, water, and other contaminants, and which permits easy access for inspection and handling. Door assemblies shall be stored off the floor on nonabsorptive strips or wood platforms. Doors and frames shall be handled carefully to prevent damage. Damaged items that cannot be restored to like-new condition shall be replaced.

PART 2 PRODUCTS

2.1 VAULT DOOR AND FRAME

Design and construction of the door and frame assembly shall conform to FS AA-D-600. The door shall be Class 5, Type IIR - right opening swing without optical device or IIL - left opening swing without optical device as indicated on the drawings, Style K - key change combination lock.

2.2 DAY GATE

The day gate shall be the manufacturer's standard product designed for use with the vault door furnished, and shall provide access control and visual security. The gate shall be dutch door type, shall be hinged on the same side as the vault door, shall swing into the vault, and shall have a locking device operable from outside by key and from inside by knob or handle.

2.3 FACTORY FINISH

Doors and frames shall be phosphatized, primed, and finished with an electrostatic baked on enamel or polyester base factory finish paint system. Color shall be W4 as identified on the finish schedule.

PART 3 EXECUTION

3.1 INSTALLATION

The vault door assembly shall be installed in strict compliance with the printed instructions and drawings provided by the manufacturer. The day gate shall be installed in a manner that will not interfere with operation of the release handle on the inside of the vault door. After installation, the door, the locking mechanism, and the inner escape device shall be adjusted for proper operation.

--End of Section --

SUBMITTAL REGISTER
(ER415-1-10)

CONTRACT NO.

TITLE AND LOCATION

CONTRACTOR

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ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. SD-01 Data										
		1	Security Vault Door; GA.										
			SD-13 Certificates										
		2	Security Vault Door; FIO.										

SAFETY PAYS

SECTION 08331

METAL ROLLING COUNTER DOORS
10/94

PART 1 GENERAL 08331-1
1.1 REFERENCES 08331-1
1.2 GENERAL 08331-1
1.3 SUBMITTALS 08331-1
1.4 DELIVERY AND STORAGE 08331-2

PART 2 PRODUCTS 08331-2
2.1 BASIC COMPONENTS 08331-2
2.2 ROLLING COUNTER DOOR (NON-RATED) 08331-3
2.3 FIRE-RATED ROLLING COUNTER DOOR 08331-3
2.4 OPERATION 08331-3
2.5 AUTOMATIC CLOSING DEVICE 08331-3
2.6 FINISH 08331-3

PART 3 EXECUTION 08331-4
3.1 INSTALLATION 08331-4
3.2 FIELD FINISHING 08331-4

SAFETY PAYS

SECTION 08331

METAL ROLLING COUNTER DOORS
10/94

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653	(1995) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1995) Fire Doors and Windows

1.2 GENERAL

Rolling counter doors shall be of the type, size, and design indicated on the drawings, and shall be the standard product of a manufacturer regularly engaged in the production of rolling counter doors. Fire-rated rolling counter doors shall be provided where indicated. Each door shall be provided with a permanent label showing the manufacturer's name and address and the model number of the door.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Rolling Counter Door Unit; GA.

Manufacturer's descriptive data and catalog cuts.

SD-04 Drawings

Rolling Counter Door Unit; GA.

Drawings including elevations of each door type, details of anchorage, details of construction, location and installation of hardware, shape and thickness of materials, details of joints and connections, and details of guides and fittings. A schedule showing the location of each counter door shall be included with the drawings.

SD-06 Instructions

Rolling Counter Door Unit; FIO.

Manufacturer's preprinted installation instructions.

SD-19 Operation and Maintenance Manuals

Rolling Counter Door Unit; FIO.

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, and simplified diagrams for the equipment as installed. Spare parts data for each different item of material and equipment specified not later than 3 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 year and 3 years of service.

1.4 DELIVERY AND STORAGE

Rolling counter doors shall be delivered to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Rolling counter doors shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants, and in a manner that permits easy access for inspecting and handling. Doors shall be handled carefully to prevent damage. Damaged items that cannot be restored to like-new condition shall be replaced.

PART 2 PRODUCTS

2.1 BASIC COMPONENTS

2.1.1 Curtain

The curtain shall be fabricated of 0.85 mm galvanized steel slats conforming to ASTM A 525, Coating Designation G60. Slats shall be approximately 32 to 38 mm wide with a depth of crown of 13 mm. Alternate slats shall be fitted with end locks to maintain curtain alignment. Bottom of curtain shall be provided with angle or tubular bar reinforcement matching the curtain, and fitted with a resilient bottom seal.

2.1.2 Jamb Guides

Guides shall be of 2.2 mm minimum thickness galvanized steel angles conforming to ASTM A 653, Coating Designation G60.

2.1.3 Barrel

The curtain shall be coiled around a steel tube of sufficient thickness and diameter to prevent deflection exceeding 2.5 mm per meter. The barrel shall contain oil tempered torsion springs capable of counterbalancing the weight of the curtain. Springs shall be calculated to provide a minimum of 7,500 operating cycles (one complete cycle of door operation will begin with the door in the closed position, move to the full open position and return to the closed position).

2.1.4 Counterbalance Assembly

Spring counterbalance shall be helical torsion type designed to include an overload factor of 25 percent and shall be grease packed and mounted in an inner shaft rod with grease sealed ball bearing units at each end.

2.1.5 Brackets

Brackets shall be a minimum 3 mm thick steel plate with provisions for bolting to the wall or to the guides.

2.1.6 Hood

The hood shall be of 0.70 mm galvanized steel conforming to ASTM A 653, Coating Designation G60.

2.1.7 Locks

The curtain shall be locked at both sides of bottom bar by a chrome-plated cylinder lock keyed into the building keying system. Lock shall be on the 113 and 114 room side of the counter door. Keying shall conform to Section 08700 HARDWARE; BUILDER'S (GENERAL PURPOSE).

2.2 ROLLING COUNTER DOOR (NON-RATED)

Rolling counter doors shall conform to the requirements specified herein and shall be constructed of galvanized steel curtains, guides and hood components.

2.3 FIRE-RATED ROLLING COUNTER DOOR

Fire-rated rolling counter doors shall be 20 minute rated and shall conform to the requirements specified and to NFPA 80 for the class indicated. Doors shall bear the labels of a recognized testing agency indicating the applicable fire resistance rating. The construction details necessary for labeled rolling counter doors shall take precedence over details indicated or specified herein. Door curtains, guides and hood shall be galvanized steel. Fire-rated rolling counter doors shall be complete with hardware, accessories, and automatic closing device. Rolling counter doors in exit corridor walls shall be provided with perimeter smoke and draft control gasketing.

2.4 OPERATION

2.4.1 Manual Operation

The curtain shall be operated by means of manual push-up with lift handles or continuous full width lift bar.

2.5 AUTOMATIC CLOSING DEVICE

Fire-rated counter doors shall be equipped with an automatic closing device which shall operate upon activation of the building's fire alarm system.

2.6 FINISH

Exposed parts of the counter door, including the curtain, bottom rail, guides, and hood shall be of uniform finish and appearance. Steel shall have galvanized coating and shall be given a prime coat of paint as standard with the

manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

Doors shall be installed in accordance with approved detail drawings and manufacturer's instructions. Anchors and inserts for guides, brackets, hardware, and other accessories shall be accurately located. Upon completion, doors shall be free from warp, twist, or distortion. Doors shall be lubricated, properly adjusted, and demonstrated to operate freely. Fire-door installation shall be in conformance with NFPA 80 for the class indicated and the manufacturer's instructions.

3.2 FIELD FINISHING

Doors to receive field finishing shall be factory primed, as required, and then shall be finished in accordance with Section 09900 PAINTING, GENERAL. Color shall be color of adjacent wall as shown on finish schedule.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 08331
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO.	TRANS-MITTAL NO.	ITEM NO.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER	REV-IEW-ER	SUBMIT	APPROV. NEEDED BY	MATER. NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
a.	b.	c.	d. through q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
			PAR. NO. SD-01 Data										
		1	Rolling Counter Door Unit; GA.										
			SD-04 Drawings										
		2	Rolling Counter Door Unit; GA.										
			SD-06 Instructions										
		3	Rolling Counter Door Unit; FIO.										
			SD-19 Operation and Maintenance Manuals										
		4	Rolling Counter Door Unit; FIO.										

SAFETY PAYS

SECTION 08353

ACCORDION PARTITIONS
05/95

PART 1 GENERAL 08353-1
1.1 REFERENCES 08353-1
1.2 SUBMITTALS 08353-1
1.3 DELIVERY AND STORAGE 08353-2
1.4 WARRANTY 08353-2

PART 2 PRODUCTS 08353-2
2.1 MATERIALS 08353-2
2.2 ACCORDION PARTITIONS 08353-3
2.3 COLOR 08353-4

PART 3 EXECUTION 08353-4
3.1 INSTALLATION 08353-4

SAFETY PAYS

SECTION 08353

ACCORDION PARTITIONS
05/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84	(1996a) Surface Burning Characteristics of Building Materials
ASTM E 90	(1996) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
ASTM E 413	(1987; R 1994) Rating Sound Insulation
ASTM F 793	(1993) Standard Classsification of Wallcovering by Durability Characteristics

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Accordion Partitions; GA.

Manufacturer's descriptive data, performance charts, catalog cuts, and installation instructions.

SD-04 Drawings

Accordion Partitions; GA.

Drawings containing complete schematic diagrams and details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-13 Certificates

Materials; FIO.

Accordion Partitions; FIO.

Certificate attesting that the materials meet the requirements specified and that partitions have specified acoustical and flame retardant properties, as determined by test.

SD-14 Samples

Accordion Partitions; FIO.

Manufacturer's standard color samples of specified surfaces and finishes.

SD-19 Operation and Maintenance Manuals

Accordion Partitions; FIO.

Six complete copies of operating instructions outlining the procedures required for electrically operated partitions. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and operating features. Data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 3 years of service.

Six complete copies of maintenance instructions explaining routine maintenance procedures including inspection, adjustments, lubrication, and cleaning. The instructions shall list possible breakdown, methods of repair, and a troubleshooting guide

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in the manufacturer's original, unopened packages and shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 MATERIALS

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer,

reasonably convenient to the site. Door and partition finishes shall have a Class A rating when tested in accordance with ASTM E 84.

2.1.1 Woven Textile Covering

The woven textile covering shall conform to ASTM E 84.

2.1.2 Hardware

Accordion partitions shall be furnished with grip handles with latch only. An upper latch with extended pulls shall be provided on units over 2.4 meters high. Hardware shall be anodized aluminum with a natural finish.

2.1.3 Sweep Strips

Sweep strips shall be vinyl or other material which will not crack or craze with severe usage. Sweep strip shall control STC to the specified rating.

2.1.4 Track

Track shall be recessed mounted and shall be of extruded aluminum. Track shall be manufacturer's standard product designed for the weight of door or partition furnished. Track sections shall be provided in the maximum lengths practicable, not less than 1.8 m long except for narrow doors and at ends of runs where short length is required. Suitable joint devices such as interlocking keys shall be provided at each joint to provide permanent alignment of track.

2.1.5 Metal Soffit

Soffit shall be provided when steel track is recessed. Soffit shall be of metal of adequate thickness to protect the ceiling from damage by door operation and shall be provided with the door manufacturer's standard neutral-color applied finish. Soffit on aluminum track shall be an integral part of the track.

2.2 ACCORDION PARTITIONS

Accordion partitions shall consist of top hung ball bearing carriers which support a system of hinged folding panels with a durable surface finish. Partitions shall have perimeter and jamb seals which shall provide the indicated STC rating. Ferrous metal parts shall be either cadmium plated or zinc coated and post shall have manufacturer's standard shop finish paint. Doors shall be manually operated. Door widths shall be as shown.

2.2.1 Pantograph Framework with Flexible Covering

Accordion partitions shall have a steel pantograph hinged framework and shall be non-STC rated, have a sound liner and shall meet the STC rating of 35, 39, 40 in accordance with ASTM E 90 and ASTM E 413. Intermediate pantographs shall be provided as required and door shall have a control device to prevent flattening of the folds when the panel is fully extended. The covering shall be 100% polyolefin as indicated on the drawings.

2.2.2 Steel Panels

Accordion partitions shall be vinyl-clad cold rolled steel panels connected by full length steel hinges. Inner surface of the panels shall be covered with insulating material. A spacing chain shall be provided to control panel spacing and extension. The STC rating of the partition shall be 44 in accordance with ASTM E 90 and ASTM E 413.

2.3 COLOR

Color shall be as indicated on the drawings and finish schedule and approved by Government Contracting Official.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's approved installation instructions.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 08353
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. SD-01 Data										
		1	Accordion Partitions; GA.										
			SD-04 Drawings										
		2	Accordion Partitions; GA.										
			SD-13 Certificates										
		3	Materials; FIO.										
		4	Accordion Partitions; FIO.										
			SD-14 Samples										
		5	Accordion Partitions; FIO.										
			SD-19 Operation and Maintenance Manuals										
		6	Accordion Partitions; FIO.										

SAFETY PAYS

SECTION 08520

ALUMINUM WINDOWS
02/94

PART 1 GENERAL 08520-1
1.1 REFERENCES 08520-1
1.2 WINDOW PERFORMANCE 08520-2
1.3 SUBMITTALS 08520-2
1.4 QUALIFICATION 08520-3
1.5 DELIVERY AND STORAGE 08520-3
1.6 WARRANTY 08520-3

PART 2 PRODUCTS 08520-3
2.1 ALUMINUM WINDOW TYPES 08520-3
2.2 WEATHERSTRIPPING 08520-4
2.3 INSECT SCREENS 08520-4
2.4 ACCESSORIES 08520-5
2.5 GLASS AND GLAZING 08520-5
2.6 FINISH 08520-5

PART 3 EXECUTION 08520-5
3.1 INSTALLATION 08520-5
3.2 ADJUSTMENTS AND CLEANING 08520-6

SAFETY PAYS

SECTION 08520

ALUMINUM WINDOWS
02/94

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(1980) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101	(1993) Voluntary Specifications for Aluminum Prime Windows and Sliding Glass Doors
AAMA 1503.1	(1988) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283	(1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 330	(1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
ASTM E 547	(1993) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential

INSECT SCREENING WEAVERS ASSOCIATED (ISWA)

ISWA IWS 089	(Rev A) Wire Fabric (Insect Screening)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(1994) Safety to Life from Fire in Buildings

and Structures

SCREEN MANUFACTURERS ASSOCIATION (SMA)

SMA 1004	(1987) Aluminum Tubular Frame Screens for Windows

1.2 WINDOW PERFORMANCE

Aluminum windows shall be designed to meet the following performance requirements. Testing requirements shall be performed by an independent testing laboratory or agency.

1.2.1 Structural Performance

Structural test pressures on window units shall be for positive load (inward) and negative load (outward) in accordance with ASTM E 330. After testing, there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There shall be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA 101 for the window types and classification specified in this section.

1.2.2 Air Infiltration

Air infiltration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 283.

1.2.3 Water Penetration

Water penetration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 547.

1.2.4 Thermal Performance

Thermal transmittance for thermally broken aluminum windows with insulating glass shall not exceed R-Value Class 0.59 m/W when tested in accordance with AAMA 1503.1.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Aluminum Windows; GA.

Manufacturer's descriptive data and catalog cut sheets.

SD-04 Drawings

Aluminum Windows; GA.

Insect Screens; GA.

Drawings indicating elevations of window, rough-opening dimensions for each type and size of window, full-size sections, thicknesses of metal, fastenings, methods of installation and anchorage, connections with other work, type of wall construction, size and spacing of anchors, method of glazing, types and locations of operating hardware, mullion and mounting details, weatherstripping details, screen details including method of attachment, and window schedules showing locations of each window type.

SD-06 Instructions

Aluminum Windows; FIO.

Manufacturer's preprinted installation instructions and cleaning instructions.

SD-13 Certificates

Aluminum Windows; FIO.

Certificates stating that the aluminum windows are AAMA certified conforming to requirements of this section. Labels or markings permanently affixed to the window will be accepted in lieu of certificates.

1.4 QUALIFICATION

Window manufacturer shall specialize in designing and manufacturing the type of aluminum windows specified in this section, and shall have a minimum of 5 years of documented successful experience. Manufacturer shall have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.5 DELIVERY AND STORAGE

Aluminum windows shall be delivered to project site and stored in accordance with manufacturer's recommendations. Damaged windows shall be replaced with new windows.

1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

PART 2 PRODUCTS

2.1 ALUMINUM WINDOW TYPES

Aluminum windows shall consist of complete units including sash, glass, thermally broken frame, weatherstripping, screens and hardware. Windows shall conform to AAMA 101. Windows shall be single-glazed and double-glazed as scheduled, and shall have a minimum condensation resistance factor of 56 when tested in

accordance with AAMA 1503.1. Operable windows shall permit cleaning the outside glass from inside the building.

2.1.1 Fixed Windows with Awning Ventilators

Aluminum windows with awning ventilators shall conform to AAMA 101 Designation A-C20 type consisting of side-hinged ventilators. Provide windows of configuration indicated. Ventilators shall be operated by one device which shall securely close the ventilators at both jambs without the use of additional manually-controlled locking device. Operating hardware except ventilator arms and rotary operators, shall be concealed within frame and sill. Ventilator arms shall be concealed when windows are closed.

2.1.2 Fixed Windows

Aluminum fixed windows shall conform to AAMA 101 F-C30 type, non-operable glazed frame, complete with provisions for reglazing in the field.

2.1.3 Projected Windows

Aluminum projected windows shall conform to AAMA 101 Designation P-C30 type. Window ventilators shall be equipped with concealed four-bar friction hinges.

2.1.4 Double Hung Windows

Aluminum double-hung windows shall conform to AAMA 101 Designation A-C20 type which operate vertically with the weight of the sash offset by a counterbalance mechanism mounted in the window to hold the sash stationary at any open position. Windows shall be provided with a tilt-in sash. Double-hung windows shall be provided with an ANSI LD 5141 sash lock with a 639 finish to secure the sash in the closed position. Counterbalancing mechanism shall be easily replaced after installation

2.1.5 Leaded Glass Window

Aluminum leaded glass window shall conform to AAMA 101 Designation F-C30, non-operable glazed frame, complete with provisions for reglazing in the field. Space between leaded glass (interior) and the protective glass (exterior) shall be vent holes to the exterior to allow air circulation and to minimize condensation. These holes shall have a non-organic filter to prevent dust and insects from entering the space between the glass panels.

2.2 WEATHERSTRIPPING

Weatherstripping for ventilating sections shall be of type designed to meet water penetration and air infiltration requirements specified in this section in accordance with AAMA 101, and shall be manufactured of material compatible with aluminum and resistant to weather. Weatherstrips shall be factory-applied and easily replaced in the field. Neoprene or polyvinylchloride weatherstripping are not acceptable where exposed to direct sunlight.

2.3 INSECT SCREENS

Insect screens shall be aluminum window manufacturer's standard design, and shall be provided at all operable ventilator window locations. Insect screens shall be fabricated of roll-formed tubular-shaped aluminum frames conforming to SMA 1004 and (18 x 16) aluminum mesh screening conforming with ISWA IWS 089, Type VII.

Screens for hopper ventilators shall be stationary type attached directly to outside of the window unit.

2.4 ACCESSORIES

2.4.1 Fasteners

Fastening devices shall be window manufacturer's standard design made from aluminum, non-magnetic stainless steel, cadmium-plated steel, nickel/chrome-plated steel or magnetic stainless steel in compliance with AAMA 101. Self-tapping sheet metal screws will not be acceptable for material thicker than 1.6 mm.

2.4.2 Hardware

Hardware shall be as specified for each window type and shall be fabricated of aluminum, stainless steel, cadmium-plated steel, zinc-plated steel or nickel/chrome-plated steel of quality established by AAMA 101.

2.4.3 Window Anchors

Anchoring devices for installing windows shall be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA 101.

2.5 GLASS AND GLAZING

2.5.1 Operable and Fixed Window

Aluminum windows shall be designed for inside glazing, field glazing, and for glass types scheduled on drawings and specified in Section 08810 GLASS AND GLAZING. Units shall be complete with glass and glazing provisions to meet AAMA 101. Glazing material shall be compatible with aluminum, and shall not require painting.

2.5.2 Leaded Window

Leaded glazing window unit shall be installed on the interior face of the double glazing unit. The double glazed unit shall be exterior side glazed with the protective glazing unit on the exterior face.

2.6 FINISH

2.6.1 Anodized Aluminum Finish

Exposed surfaces of aluminum windows shall be finished with anodic coating, dark bronze color, conforming to AA DAF-45: Architectural Class I, AA-M10-C22-A44, color anodic coating, 0.018 mm or thicker. Finish shall be free of scratches and other blemishes.

PART 3 EXECUTION

3.1 INSTALLATION

Aluminum windows shall be installed in accordance with approved shop drawings and manufacturer's published

instructions. Aluminum surfaces in contact with masonry, concrete, wood and dissimilar metals other than stainless steel, zinc, cadmium or small areas of white bronze, shall be protected from direct contact using protective materials recommended by AAMA 101. The completed window installation shall be watertight in accordance with Section 07920 CAULKING AND SEALANTS. Glass and glazing shall be installed in accordance with requirements of this section and Section 08810 GLASS AND GLAZING.

3.2 ADJUSTMENTS AND CLEANING

3.2.1 Hardware Adjustments

Final operating adjustments shall be made after glazing work is complete. Operating sash or ventilators shall operate smoothly and shall be weathertight when in locked position.

3.2.2 Cleaning

Aluminum window finish and glass shall be cleaned on exterior and interior sides in accordance with window manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring window finish and glass surfaces.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 08520
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-01 Data										
		1	Aluminum Windows; GA.										
			SD-04 Drawings										
		2	Aluminum Windows; GA.										
		3	Insect Screens; GA.										
			SD-06 Instructions										
		4	Aluminum Windows; FIO.										
			SD-13 Certificates										
		5	Aluminum Windows; FIO.										

SAFETY PAYS

SECTION 08700

08700-BUILDERS' HARDWARE
08700-11/95

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***** SAFETY PAYS *****

SECTION 08700

BUILDERS' HARDWARE
11/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283	(1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen
ASTM F 883	(1997) Padlocks

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA-01	(Effective thru Jun 1995) Directory of Certified Locks & Latches
BHMA-02	(Effective thru Jul 1995) Directory of Certified Door Closers
BHMA A156.1	(1997) Butts and Hinges
BHMA A156.2	(1996) Bored and Preassembled Locks and Latches
BHMA A156.3	(1994) Exit Devices
BHMA A156.4	(1992) Door Controls - Closers
BHMA A156.5	(1992) Auxiliary Locks & Associated Products
BHMA A156.6	(1994) Architectural Door Trim
BHMA A156.7	(1988) Template Hinge Dimensions
BHMA A156.8	(1994) Door Controls - Overhead Holders
BHMA A156.13	(1994) Mortise Locks & Latches
BHMA A156.16	(1989) Auxiliary Hardware
BHMA A156.18	(1993) Materials and Finishes
BHMA A156.20	(1989) Strap and Tee Hinges and Hasps

BHMA A156.21	(1996) Thresholds

DOOR AND HARDWARE INSTITUTE (DHI)

DHI-02	(1994) Installation Guide for Doors and Hardware
DHI-03	(1989) Keying Systems and Nomenclature
DHI-04	(1976) Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames
DHI-05	(1990) Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames
DHI A115-W	(Varies) Wood Door Hardware Standards (Incl A115-W1 thru A115-W9)

FEDERAL STANDARDS (FED-STD)

FED-STD 795	(Basic) Uniform Federal Accessibility Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1995) Fire Doors and Windows
NFPA 101	(1997) Safety to Life from Fire in Buildings and Structures

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Hardware and Accessories; FIO.

Manufacturer's descriptive data, technical literature, catalog cuts, and installation instructions. Spare parts data for locksets, exit devices and closers after approval of the detail drawings, and not later than 1 month prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-07 Schedules

Hardware Schedule; GA.

Hardware schedule listing all items to be furnished. The schedule shall include for each item: the quantities; manufacturer's name and catalog numbers; sizes; detail information or catalog cuts; finishes; door and frame size and materials; location and hardware set identification cross-references to drawings; corresponding reference

standard type number or function number from manufacturer's catalog if not covered by ANSI or BHMA; and list of abbreviations and template numbers.

Keying Schedule; GA.

Keying schedule developed in accordance with DHI-03, after the keying meeting with the user.

SD-13 Certificates

Hardware and Accessories; FIO.

The material supplier's or hardware manufacturer's certificates of compliance stating that the supplied material or hardware item meets specified requirements. Each certificate shall be signed by an official authorized to certify in behalf of material supplier or product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply. A statement that the proposed hardware items appear in BHMA-01 and BHMA-02 directories of certified products may be submitted in lieu of certificates. A separate Certificate of Compliance attesting that hardware items conform to the "Buy American Act" shall be included.

SD-19 Operation and Maintenance Manuals

Hardware and Accessories; FIO.

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Manuals will be submitted in accordance with the requirements of Section 01800 EQUIPMENT OPERATING, MAINTENANCE AND REPAIR MANUALS.

1.3 DELIVERY, STORAGE, AND HANDLING

Hardware shall be delivered to the project site in the manufacturer's original packages. Each article of hardware shall be individually packaged in the manufacturer's standard commercial carton or container, and shall be properly marked or labeled to be readily identifiable with the approved hardware schedule. Each change key shall be tagged or otherwise identified with the door for which its cylinder is intended. Where double cylinder functions are used or where it is not obvious which is the key side of a door, appropriate instructions shall be included with the lock and on the hardware schedule. Manufacturer's printed installation instructions, fasteners, and special tools shall be included in each package.

1.4 SPECIAL TOOLS

Special tools, such as those supplied by the manufacturer, unique wrenches, and dogging keys, shall be provided as required to adjust hardware items.

PART 2 PRODUCTS

2.1 GENERAL HARDWARE REQUIREMENTS

Hardware shall conform to the requirements specified herein and the HARDWARE SETS listing at the end of this section. Hardware set numbers correspond to the set numbers shown on the drawings. Hardware items providing

accessibility and usability for physically handicapped shall comply with FED-STD 795.

2.2 TEMPLATES

Requirements for hardware to be mounted on metal doors or metal frames shall be coordinated between hardware manufacturer and door or frame manufacturer by use of templates and other information to establish location, reinforcement required, size of holes, and similar details. Templates of hinges shall conform to BHMA A156.7.

2.3 HINGES

Hinges shall conform to BHMA A156.1. Hinges used on metal doors and frames shall also conform to BHMA A156.7. Except as otherwise specified, hinge sizes shall conform to the hinge manufacturer's printed recommendations.

2.3.1 Hinges for Reverse Bevel Doors with Locks

Hinges for reverse bevel doors with locks shall have pins that are made nonremovable by means such as a set screw in the barrel, or safety stud, when the door is in the closed position. Exterior and fire rated hinge pins to be non-ferrous.

2.3.2 Contractor's Option

Hinges with antifriction bearings may be furnished in lieu of ball bearing hinges, except where prohibited for fire doors by the requirements of NFPA 80.

2.3.3 Pivot Hinges

Pivot hinges shall conform to BHMA A156.4.

2.3.4 Spring Hinges

Full mortise heavy duty double acting spring hinges shall conform to BHMA A156.17.

2.4 LOCKS AND LATCHES

To the maximum extent possible, locksets, latchsets and deadlocks shall be the products of a single manufacturer. Lock fronts for double-acting doors shall be rounded. Strikes for wood frames and pairs of wood doors shall be furnished with wrought boxes. Lock and latch set trim (knobs, lever handles, roses and escutcheons) shall be of a simple design in accordance with manufacturer's standard practice. Knob diameter shall be 54 to 57 mm.

2.4.1 Mortise Lock and Latchsets

Mortise lock, latchsets, and strikes shall be series 1000 and shall conform to BHMA A156.13, operational Grade 1. Mortise type locks and latches for doors 44 mm thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks shall have armored fronts.

2.4.2 Bored Lock and Latchsets

Bored lock, latchsets, and strikes shall be series 4000 and shall conform to BHMA A156.2, Grade 2. Bored type locks and latches for doors 44 mm thick shall have adjustable bevel fronts or otherwise conform to the shape of the

door.

2.4.3 Auxiliary Locks and Associated Products

Bored and mortise deadlocks and latchsets, narrow style locks and rim locks shall conform to BHMA A156.5. Strike boxes shall be furnished with dead bolt and latch strikes for Grade 1.

2.4.4 Lock Cylinders (Mortise, Rim and Bored)

Lock cylinders shall comply with BHMA A156.5. The base currently utilizes a "BEST" integrated master keying system. Interchangeable cores provided shall be compatible with the existing "BEST" system. Lock cylinder shall have not less than seven pins. Cylinders shall have key removable type cores. Construction interchangeable cores shall be provided. Disassembly of knob or lockset shall not be required to remove core from lockset. All locksets, exit devices, and padlocks shall accept same interchangeable cores.

2.4.5 Padlocks

Padlocks shall conform to ASTM F 883. Straps, tee hinges, and hasps shall conform to BHMA A156.20.

2.4.6 Lock Trim

Lock trim shall be cast, forged, or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of BHMA A156.2 or BHMA A156.13, knobs, lever handles, roses, and escutcheons shall be 1.27 mm thick, if unreinforced. If reinforced, the outer shell shall be 0.89 mm thick and the combined thickness shall be 1.78 mm except that knob shanks shall be 1.52 mm thick.

2.5 EXIT DEVICES AND EXIT DEVICE ACCESSORIES

Exit devices and exit device accessories shall conform to BHMA A156.3, Grade 1.

2.5.1 Exit Devices and Auxiliary Items

Trim shall be of wrought construction and commercial plain design with straight, beveled, or smoothly rounded sides, corners, and edges. Adjustable strikes shall be provided for rim type and vertical rod devices. Open back strikes shall be provided for pairs of doors with mortise and vertical rod devices; except open back strikes shall be used on labeled doors only where specifically provided for in the published listings. Touch bars shall be provided in lieu of conventional crossbars and arms. Escutcheons shall be provided not less than 175 by 55 mm. Escutcheons shall be cut to suit cylinders and operating trim.

2.6 KEYING

Locks shall be keyed in accordance with the Contracting Officer instructions. Locks shall be furnished with the manufacturer's standard construction key system. Keys for locks shall be stamped with the inscription "U.S. Property - Do Not Duplicate." Keys shall be supplied as follows:

Locks:	2 change keys each lock.
Master keyed sets:	2 keys each set.
Grand master keys:	2 total.
Construction keys:	2 total.
Blank keys:	2 each core.

The keys shall be furnished to the Contracting Officer arranged for key control system storage in sets or subsets as directed.

2.7 DOOR CLOSING DEVICES

Door closing devices shall conform to BHMA A156.4, Grade 1. Closing devices shall be products of one manufacturer for each type specified. The opening resistance of closing devices shall not exceed 67 N applied at the latch stile or exceed 22 N where low opening resistance is scheduled.

2.7.1 Surface Type Closers

Surface type closers shall be Grade 1, Series C02000 Full Cover with options PT-4H, Size 1 or 2 through Size 6, and PT-4D with back check position valve. Except as otherwise specified, sizes shall conform to the manufacturer's published recommendations. Closers for outswinging exterior doors shall have parallel arms or shall be top jamb mounted. Closers for doors close to a wall shall be of narrow projection so as not to strike the wall at the 90-degree open position.

2.7.2 NOT USED

2.8 DOOR CONTROLS - OVERHEAD HOLDERS

Door controls - overhead holders shall conform to BHMA A156.8.

2.9 ARCHITECTURAL DOOR TRIM

Architectural door trim shall conform to BHMA A156.6.

2.9.1 Door Protection Plates

2.9.1.1 Kick Plates

Kick plates shall be Category J100, plastic. Width of plates shall be 50 mm less than door width for single doors and 25 mm less for pairs of doors. Height shall be 400 mm, except where the bottom rail is less than 400 mm, the plate shall extend to within 13 mm of the panel mold or glass bead.

2.9.1.2 Armor Plates

Armor plates shall be Type stainless steel, 900 mm in height, and 50 mm less in width than the width of the door for single doors and 25 mm less for pairs of doors. Edges of metal plates shall be beveled. Where the door has a louver panel, the armor plate shall be omitted if top of louver frame is more than 500 mm above the bottom of the door.

2.9.2 Push Plates

2.9.2.1 Combination Push-Pull Plates

Combination push-pull plates shall be Category J300, 3 mm thick minimum bronze beveled four edges.

2.9.2.2 Flat Plates

Flat plates shall be Category J300, bronze, size as shown. Edges of metal plates shall be beveled.

2.9.3 Door Pulls and Push/Pull Units

2.9.3.1 Arm Pulls

Arm pulls shall be Category J400, double base, bronze.

2.9.4 Push and Pull Bars

Push and pull bars shall be Category J500, bronze. Edges of mounting plates shall be beveled.

2.9.5 Door Edge Guards

Door edge guards shall be furnished to protect door edges with the required cut-outs for hardware items such as hinges, flush bolts, and locks. Door edge guards shall satisfy fire door ratings. Door edge guards shall be finished as noted on the schedule.

2.10 AUXILIARY HARDWARE

Auxiliary hardware, consisting of door holders, door viewers and door stops shall conform to BHMA A156.16. Lever extension flush bolts shall be Type L14081. Dust-proof strikes shall be Type L04011 for doors that are not fire rated. Dust-proof strikes shall be Type L04021 for fire rated doors. Overhead door stops shall be type 1 and conform to BHMA A156.8. Door bumper to be series 170 by Bommer. Other auxiliary hardware of the types listed below, shall conform to BHMA A156.16.

2.11 MISCELLANEOUS

2.11.1 Metal Thresholds

Thresholds shall conform to BHMA A156.21. Thresholds for exterior doors shall be extruded aluminum of the type indicated and shall provide proper clearance and an effective seal with specified weather stripping. Latching thresholds shall conform to BHMA A156.3, Type 26, and of such height that the bottom of the door shall be 3 mm over the tread of the threshold and 3 mm below the top of the stop. Where required, thresholds shall be modified to receive projecting bolts of flush bolts and exit devices. Thresholds for doors in the Barracks "SCB", Battalion HQ, Company Operations, Dining Facility and Brigade HQ buildings shall be accessible to the handicapped and shall be beveled with slopes not exceeding 1:2 and with heights not exceeding 13 mm. Air leakage rate of weatherstripping shall not exceed 0.775 l/s per lineal meter of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.11.2 Rain Drips

Extruded aluminum, not less than 1.78 mm thick, bronze anodized. Door sill rain drips shall be 38 mm to 44 mm high by 16 mm projection. Overhead rain drips shall be approximately 38 mm high by 63 mm projection and shall extend 50 mm on either side of the door opening width.

2.11.3 Aluminum Housed Type Weatherseals

Weatherseals of the type indicated shall consist of extruded aluminum retainers not less than 1.78 mm wall

thickness with vinyl, neoprene, silicone rubber, polyurethane or vinyl brush inserts. Aluminum shall be bronze anodized. Weatherseal material shall be of an industrial/commercial grade. Seals shall remain functional through all weather and temperature conditions. Air leakage rate of weatherstripping shall not exceed 0.775 L/s per lineal meter of crack when tested in accordance with ASTM E 283at standard test conditions.

2.11.4 Gasketing

Gasketing shall be a compression type seal, silicon based, self-adhesive product for use on steel door frames with steel doors for 1-1/2 hour B-label. Color shall be bronze. Air leakage rate of weatherstripping shall not exceed 0.775 L/s per lineal meter of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.11.5 Key Control Storage System

Key control storage system shall be provided and installed in locations as directed by the Contracting Officer. Each key control storage system shall conform to BHMA A156.5, Type E8351, capacity 150, and shall be properly labeled for key identification. Provide key control system(s) for each building as follows; Barracks (7039) one, Dining (7048) one, Company Operations (7075) eight, Brigade (7078) one, Battalion (7076, 7077, 7081,7084) one for each.

2.11.6 HASP

Hasps shall conform to BHMA A156.20, Grade 1.

2.12 FASTENINGS

Fastenings of proper type, size, quantity, and finish shall be supplied with each article of hardware. Machine screws and expansion shields shall be used for attaching hardware to concrete or masonry. Fastenings exposed to the weather in the finished work shall be of brass, bronze, or stainless steel. Sex bolts, through bolts, or machine screws and grommet nuts, where used on reverse-bevel exterior doors equipped with half-surface or full-surface hinges, shall employ one-way screws or other approved tamperproof screws. Screws for the jamb leaf of half-mortise and full-surface hinges attached to structural steel frames shall be one-way or other approved tamperproof type.

2.13 FINISHES

Unless otherwise specified, finishes shall conform to those identified in BHMA A156.18. Where painting of primed surfaces is required, painting is specified in Section 09900 PAINTING, GENERAL.

2.13.1 Hinges

Hinges shall have the following finishes:

a. Aluminum door hinges: 612.

b. Interior door hinges and inswinging exterior door hinges: 612/639.

c. Outswinging exterior door hinges: 612/639

2.13.2 Lock and Door Trim

Lock and door trim shall have the following finishes:

a. Aluminum door lock and trim: 612.

b. Main entrance door lock and trim: 612.

c. Other door lock and trim: 612.

2.13.3 Door Closer

Door closer finishes shall be 612/691.

2.13.4 Miscellaneous Hardware

Miscellaneous hardware shall have the following finish: 612.

2.14 HARDWARE FOR FIRE DOORS

Hardware for fire doors shall conform to the requirements of NFPA 80and NFPA 101.

2.15 EXIT GATE

Provide exit gate device, as shown on the contract documents, to prevent personnel from transversing the multi-story stairway into the basement. The device shall automatically close when an electromagnetic device receives the single from the fire alarm system and the personnel movement from the second level is prevented by the device from transversing into the basement.

PART 3 EXECUTION

3.1 APPLICATION

Hardware shall be located in accordance with DHI-04 and DHI-05. When approved, slight variations in locations or dimensions will be permitted. Application shall be in accordance with DHI-02 or DHI A115-W. Use through bolts and nuts or sex bolts on exterior doors to attach door control devices such as closers and holders. For attachments not using through bolts or sex bolts, the contractor shall submit to the Contracting Officer Representative for approval documentation from the door manufacturer verifying the adequacy of alternate fastening methods.

3.1.1 Hardware for Fire Doors

Hardware for fire doors shall be installed in accordance with the requirements of NFPA 80. Exit devices installed on fire doors shall have a visible label bearing the marking "Fire Exit Hardware". Other hardware installed on fire doors, such as locksets, closers, and hinges shall have a visible label or stamp indicating that the hardware items have been approved by an approved testing agency for installation on fire-rated doors.

3.1.2 Door-Closing Devices

Door-closing devices shall be installed and adjusted in accordance with the templates and printed instructions supplied by the manufacturer of the devices. Insofar as practicable, doors opening to or from halls and corridors

shall have the closer mounted on the room side of the door.

3.1.3 Key Control Storage Systems

Key control storage system shall be installed where directed by the Contracting Officer.

3.1.4 Kick Plates and Mop Plates

Kick plates shall be installed on the push side of single-acting doors and on both sides of double-acting doors. Mop plates shall be installed on the pull side of the single acting doors.

3.1.5 Auxiliary Hardware

Lever extension flush bolts shall be installed at the top and bottom of the inactive leaf of pairs of doors. The bottom bolt shall operate into a dust-proof floor strike or threshold.

3.1.6 Thresholds

Thresholds shall be secured with a minimum of three fasteners per single door width and six fasteners per double door width with a maximum spacing of 300 mm. Exterior thresholds shall be installed in a bed of sealant with expansion anchors and stainless steel screws, except that bronze or anodized bronze thresholds shall be installed with expansion anchors with brass screws. Minimum screw size shall be No. 10 length, dependent on job conditions, with a minimum of 19 mm thread engagement into the floor or anchoring device used.

3.1.7 Rain Drips

Door sill rain drips shall align with the bottom edge of the door. Overhead rain drips shall align with bottom edge of door frame rabbet. Drips shall be set in sealant and fastened with stainless steel screws.

3.1.8 Weatherseals

Weatherseals shall be located as indicated, snug to door face and fastened in place with color matched metal screws after door and frames have been finish painted. Screw spacing shall be as recommended by manufacturer.

3.1.9 Gasketing

Gasketing shall be installed at the inside edge of the hinge and head and latch sides of door frame. Frames shall be toleranced for a 3 mm clearance between door and frame. Frames shall be treated with tape primer prior to installation.

3.2 OPERATIONAL TESTS

Prior to acceptance of any electrical hardware system, an operational test shall be performed to determine if devices are operating as intended by the specifications. Wiring shall be tested for correct voltage, current carrying capacity, and proper grounding. Stray voltages in lock wiring shall be eliminated to prevent locking devices from releasing in critical situations.

3.3 HARDWARE SETS

*** SAFETY PAYS ***

HW-A1 (SOLDIER COMMUNITY BUILDING BASEMENT)

11/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	ST1E, ST2E
1 ea	Closer, C02011, 691	
1 ea	Exit Device, Type 3, FO8, 612 (no cylinder operation)	
1 ea	Wall Stop, L22251, 612	
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	

HW-A2 (SOLDIER COMMUNITY BUILDING FIRST FLOOR)

6 pr.	Hinges, A5111, 639	01A
4 ea	Closer, C02081, 691	
4 ea	Pull, J402, 612	
4 ea	Push Bar, J501, 612	
4 ea	Floor Stop, L02131, 612	
8 ea	Kick Plate, J102, 190 mm X 875 mm B3E, 612	
4 ea	Rain Drip, 612	
2 ea	Threshold, J19150, 612	
4 sets	Weatherstripping, 612 (coordinate w/alum. door mfr.)	
4 sets	Mortise Astrical Weatherstripping (coordinate w/alum door mfr.)	
4 ea	Door Shoe (coordinate w/alum door mfr.)	

HW-A3

6 pr.	Hinges, A5111, 639	01B
4 ea	Closer, C02081, 691	
2 ea	Exit Device, Type 3, FO3 (Tubular Lever) RHRB, 612	
2 ea	Exit Device, Typr 8, FO3 (Tubular Lever) LHRB, 612	
2 ea	Open Back Strike, 612	
2 ea	Threshold, J19150, 612	
4 ea	Floor Stop, L02131, 612	
8 ea	Kick Plate, J102, 190 mm X 875 mm B3E, 612	

HW-A4

11/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	07A
1 ea	Lockset, F04, Grade 2, 612	
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Overhead Stop, L01541, 612	

HW-A5

11/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	10A
1 ea	Latch Bolt, F01, 612	
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Closer, C02021, 691	
1 ea	Wall Stop, L22251, 612	

*** SAFETY PAYS ***

HW-A6

11/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	11A
1 ea	Lockset, F04, 612	
2 ea	Kick Plate, ANSI J102, 200 mm X 875 mm B3E, 612	
1 ea	Closer, C02011, 691	
1 ea	Wall Stop, L22251, 612	

HW-A7

11/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	12A
1 ea	Lockset, F86, 612	
1 ea	Deadbolt, E2151, 612	
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Wall Stop, L22251, 612	

HW-A8

1 1/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	13A
1 ea	Lockset, F04, 612	
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Closer, C02011, 691	
1 ea	Wall Stop, L22251, 612	

HW-A9

1 1/2 pr	Hinges, A5111, 114 mm X 114 mm, 639	14A, 15A
1 ea	Closer, C02051, 691	
1 ea	Pull, J401, 612	
1 ea	Push Plate, J301, 100 mm X 400 mm B4E, 612	
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Wall Stop, L22251, 612	

HW-A10

1 1/2 pr	Hinges, A5111, 114 mm X 114 mm, 639	16A, 16B
1 ea	Lockset, F01, 612	
1 ea	Closer, C02061, 691	
1 ea	Padlock, P01, Grade 4, Options ‘B’ and ‘G’	
1 ea	Hasp, A83351	
1 ea	Armor Plate, J101,B3E, 612	
1 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612 (Exterior Face)	
1 ea	Edging, J204 X 900 mm, 612	
1 ea	Edging, J205 X 900 mm, 612 (Cut for Butts)	
1 ea	Rain Drip 612	
1 ea	Threshold, J12100, 612	
1 set	Weatherstripping, 612	
1 ea	Mortise Door Shoe	

HW-A11

3 pr	Hinges, A5111, 114 mm X 114 mm, 639	17A
1 ea	Lockset, F01, 612 (Active Leaf)	
1 ea	Padlock, P01, Grade 4, Options ‘B’ and ‘G’	
1ea	Hasp, A83351	
2 ea	Flushbolt, L04081, 612 (Inactive Leaf)	
1 ea	Dust Proof Strike, L04011, 612 (Inactive Leaf)	
1 ea	Closer, C02061, 691 (Active Leaf)	
1 ea	O/H Holder, C08511, 691 (Inactive Leaf)	
2 ea	Armor Plate, J101, B3E, 612	
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612 (Exterior Face)	
2 ea	Edging, J204 X 900 mm, 612 (Cut for Butts RHRB and LHRB)	
1 ea	Edging, J205 X 900 mm, 612 (Cut for Flushbolts)	
1 ea	Edging, J205 X 900 mm, 612 (Active Leaf)	
1 ea	Threshold, J12100, 612	
1 set	Weatherstripping, 612	
2 ea	Rain Drip, 612	
2 set	Mortise Astrigal Weatherstripping	
2 ea	Mortise Door Shoe	

HW-A12

3 pr.	Hinges, A5111, 639	V1A, V1C
2 ea	Closer, C02081, 691	V4A,V4C
1 ea	Exit Device, Type 3, FO3 (Tubular Lever) RHRB, 612	
1 ea	Exit Device, Type 8, FO3 (Tubular Lever) LHRB, 612	
1 ea	Open Back Strike, 612	
2 ea	Floor Stop, L02131, 612	
4 ea	Kick Plate, J102, 190 mm X 875 mm B3E, 612	
1 ea	Rain Drip, 612	
1 ea	Threshold, J19150, 612	
1 set	Weatherstripping, 612 (coordinate w/alum. door mfr.)	
1 set	Mortise Astrigal Weatherstripping (coordinate w/alum door mfr.)	
2 ea	Mortise Door Shoe (coordinate w/alum door mfr.)	

HW-A13

3 pr.	Hinges, A8111, 639	V1B, V1B
2 ea	Closer, C02041, 691	
1 ea	Exit Device, Type 3, FO8 (Tubular Lever) RHRB, 612	
1 ea	Exit Device, Type 8, FO8 (Tubular Lever) LHRB, 612	
1 ea	Open Back Strike, 612	
4 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
2 ea	Wall Stop, L22251, 612	

HW-A14 (BARRACKS BUILDING FIRST FLOOR)

1 1/2 pr.	Hinges, A8111, 639	V1D, V1D

***** SAFETY PAYS *****

1 ea	Closer, C02081, 691	
1 ea	Pull, J401, 612	
1 ea	Push Bar, J501, 612	
1 ea	Floor Stop, L02131, 612	
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Threshold, J19150, 612	

HW-A15

1 1/2 pr	Hinges, ANSI A5111, 114mm X 114 mm, 639	MR1A
1 ea	Lockset, F05, 612	MR1B
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	MR2A
1 ea	Floor Stop, L02131, 612	MR2B
1 ea	Closer, C02061, 691	
1 ea	Rain Drip, 612	
1 ea	Threshold, J12100, 612	
1 set	Weatherstripping, 612	
1 ea	Mortise Door Shoe	

HW-A16

1 1/2 pr.	Hinges, A5111, 639	C1A, C3A
1 ea	Closer, C02081, 691	C4A, C6A
1 ea	Exit Device, Type 1, FO3, 612	
1 ea	Floor Stop, L02131, 612	
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Rain Drip, 612	
1 ea	Threshold, J19150, 612	
1 set	Weatherstripping, 612	
1 ea	Mortise Door Shoe	

HW-A17

11/2 pr	Hinges, A5111, 114 mm X 114 mm, 639	ST1A, ST2A
1 ea	Closer, C02061, 691	ST3A, ST4A
1 ea	Exit Device, Type 3, FO3, 612	ST5A, ST6A
1 ea	Floor Stop, L02131, 612	ST7A, ST8A
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Rain Drip, 612	
1 ea	Threshold, J12100, 612	
1 set	Weatherstripping, 612	
1 ea	Mortise Door Shoe	

HW-A18

11/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	ST1B, ST2B
1 ea	Closer, C02011, 691	ST3B, ST4B

1 ea	Exit Device, Type 3, FO8, 612 (no cylinder operation)	ST5B, ST6B
1 ea	Wall Stop, L22251, 612	ST7B, ST8B
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	

HW-A19

11/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	J1A, J2A
1 ea	Lockset F04, 612	J3A, J4A
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Closer, C02021, 691	

HW-A20

11/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	E1A,E2A
1 ea	Lockset, F04, 612	E3A,E4A
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Closer, C02021, 691	

HW-A21

1 1 /2 pr	Hinges, A8111, 114 mm X 114 mm, 639	M1A,M2A
1 ea	Lockset, F04, 612	
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Closer, C02011, 691	
1 ea	Wall Stop, L22251, 612	

HW-A22

1 1/2 pr.	Hinges, A5111, 639	V2A, V3A
1 ea	Closer, C02081, 691	V5A, V6A
1 ea	Exit Device, Type 1, FO3, 612	
1 ea	Floor Stop, L02131, 612	
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Rain Drip, 612	
1 ea	Threshold, J12100, 612	
1 set	Weatherstripping, 612	
1 ea	Mortise Door Shoe	

HW-A23 (BARRACKS BUILDING SECOND FLOOR)

1 1/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	ST1C, ST2C
1 ea	Closer, C02011, 691	ST3C, ST4C
1 ea	Exit Device, Type 3, FO8, 612 (no cylinder operation)	ST5C, ST6C
1 ea	Wall Stop, L22251, 612	ST7C, ST8C
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	

HW-A24

1 1/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	J5A, J6A
1 ea	Lockset, F04, 612	J7A, J8A

2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Closer, C02051, 691	
1 ea	Adjustable Hinge Pin L02223	

HW-A25

11/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	E5A,E6A
1 ea	Lockset, F04, 612	E7A,E8A
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	SR1A, SR2A
1 ea	Closer, C02021, 691 (Electrical Closets only)	
1 ea	Closer, C02011, 691 (Storage Rooms only)	
1 ea	Adjustable Hinge Pin L02223 (Electrical Closets only)	
1 ea	Wall Stop, L22251, 612 (Storage Rooms only)	

HW-A26 (BARRACKS BUILDING THIRD FLOOR)

1 1/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	ST1D, ST2D
1 ea	Closer, C02011, 691	ST3D, ST4D
1 ea	Exit Device, Type 3, FO8, 612 (no cylinder operation)	ST5D, ST6D
1 ea	Wall Stop, L22251, 612	ST7D, ST8D
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	

HW-A27

1 1/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	J9A, J10A
1 ea	Lockset, F04, 612	J11A, J12A
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Closer, C02021, 691	

HW-A28

1 1/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	E9A,E10A
1 ea	Lockset, F04, 612	E11A,E12A
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	SR3A, SR4A
1 ea	Closer, C02021, 691 (Electrical Closets only)	
1 ea	Closer, C02011, 691 (Storage Rooms only)	
1 ea	Wall Stop, L22251, 612 (Storage Rooms only)	

HW-A29 (BARRACKS SUITES)

1 1/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	A
1 ea	Lockset, F13, 612	
1 ea	Closer, C02021, 691	
2 ea	Kick Plate, J102, 200 mm X 875 mm B3E, 612	
1 ea	Wall Stop, L22251, 612	
1 ea	Door Viewer, L03171, 612	

HW-A30

1 1/2 pr	Hinges, A8111, 114 mm X 114 mm, 639	B, E

1 ea Lockset, F13, 612
2 ea Kick Plate, J102, 200 mm X 875 mm B3E, 612
1 ea Wall Stop, L22251, 612 (Door 'B' only)

HW-A31

11/2 pr Hinges, A8131, 639 C, D
1 ea Locksetr, F76, Grade 2, 612
2 ea Kick Plate, J102, 200 mm X 675 mm B3E, 612
1 ea Wall Stop, L22251, 612

HW-A32

1/2 pr Hinges, A8131, 89 mm X 89 mm, 639 F, G
1 ea Lockset, F81, Grade 2, 612
2 ea Kick Plate, J102, 200 mm X 675 mm B3E, 612
1 ea Wall Stop, L22251, 612

HW-A33 (Barrier Gate Located in Stairwell ST1B and ST4B)

2 ea Spring Hinge (coordinate with gate mfr)
1ea Electromagnetic Door Holder, ANSI

COMPANY OPERATIONS HEADQUARTERS BUILDING (7075) "B"

HW-B1

1-1/2 pr. Hinges, A8111, 639
1 ea. Exit Device, Type 3, F08 (no cylinder operation), 612
1 ea. Closer, C02021, 691
1 ea. Kickplate, J106, 4mm clear plastic (Barracks only)

HW-B2

1-1/2 pr. Hinges, A8111, 639
1 ea. Lockset, F07, 612
1 ea. Closer, C02011, 691
1 ea. Lockset, F14 (Janitor Closets only), 612
1 ea. Kick Plate, J106, 4mm clear plastic
1 ea. Wall Stop, L02251, 612

HW-B3

NOT USED

HW-B4

1-1/2 pr. Hinges, A8111, 639
1 ea. Closer, C02011, 691

1 ea. Push Plate, J300, 100mm x 404mm x 1.3mm, 612
1 ea. Pull Plate, J400, 100mm x 404mm x 1.3mm, 612
1 ea. Kick Plate, J106, 4mm clear plastic
1 ea. Wall Stop, L02251, 612

HW-B5

3 pr. Hinges, A1111, 639
1 ea. Dead Lock, E8221, 612
2 ea. Pull, J401, 612
1 ea. Cylinder, E19211, 612
2 ea. Push Bar, J501, 612
2 ea. Flush Bolts, L14081, 612
2 ea. Closers, C02081, 691
2 ea. Kick Plates, J106, 4mm clear plastic
1 ea. Threshold, Bronze
2 sets. Weatherstripping

HW-B6

1-1/2 pr. Hinges, A8111, 639
1 ea. Lockset, F04, 612
1 ea. Closer, C02011, 639
1 ea. Wall Stop, L02251, 612

HW-B7

3 pr. Hinges, A2111, 639
1 ea. Lockset, F01, 612
1 ea. Padlock, P01, Grade 4, Options B and G
1 ea. Hasp, A83351
2 sets Weatherstripping
2 ea. Rain Drip, 612
1 ea. Threshold, J36130, 612
1 ea. Dust Proof Strike, L04011, 612
2 ea. Flush Bolts, L14081, 612
2 ea. O.H. Holder, C08511, 612

HW-B8

1-1/2 pr. Hinges, A2111, 639
1 ea. Lockset, F01, 612
1 ea. Padlock, P01, Grade 4, Options B and G
1 ea. Hasp, A83351
1 sets Weatherstripping
1 ea. Rain Drip, 612
1 ea. Threshold, J36130, 612
1 ea. O.H. Holder, C08511, 691

HW-B9 Hardware By Door Manufacturer
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HW-B10

1-1/2 pr. Hinges, A8111, 639
1 ea. Lockset, F05, 612
1 ea. Wall Stop, L02251, 612

HW-B11

3 pr. Hinges, A2111, 639
1 ea. Closer, C02061, 691
1 ea. Exit Device, Type 3, F05, 612
1 ea. Threshold, J600 (Bumper type similar to Pemko 181B or Reese or Zero), 612
2 ea. Flush Bolts, L14081, 612
1 ea. Dust Proof Strike, L04011, 612
2 sets Weatherstripping
2 ea. Rain Drip, 612

HW-B12

3 pr. Hinges, A8111, 639
1 ea. Lockset, F07, 612
1 pr. Flush Bolts, L14081, 612
1 ea. Dust Proof Strike, L04011, 612
2 ea. Kickplates, J106, 4mm clear plastic
2 ea. Wall Stop, L02251, 612

HW-B13

2 sets Bi-Folding hardware, D8621, 612
2 ea. Single Dummy Trim matching other Lockset trim, 612

HW-B14

3 pr. Hinges, A8111, 639
1 ea. Lockset, F07, 612
1 ea. Closer, C02011, 691
1 pr. Flush Bolts, L14081, 612
1 ea. Dust Proof Strike, L04011, 612
2 ea. Kickplates, J106, 4mm clear plastic
2 ea. Floor Stop, L02131, 612

HW-B15

1-1/2 pr. Hinges, A8111, 639
1 ea. Lockset, F05, 612

1 ea. Closer, C02011, 691
1 ea. Wall Stop, L02251, 612

HW-B16

3 pr. Hinges, A8111, 639
1 ea. Lockset, F04, 612
1 ea. Closer, C02021, 691
1 pr. Flush Bolts, L14081, 612
1 ea. Dust Proof Strike, L04011, 612
2 ea. Kickplates, J106, 4mm clear plastic
2 ea. Wall Stop, L02251, 612

BRIGADE HEADQUARTERS BUILDING (7078) "C"

HW-C1

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F07
1 ea. Closer, C02011
1 ea. Lockset, F14 (Janitor Closets only)
1 ea. Kick Plate, J106, 4mm clear plastic
1 ea. Wall Stop, L02251

HW-C2

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F19
1 ea. Wall Stop, L02251

HW-C3

1-1/2 pr. Hinges, A8111
1 ea. Closer, C02011
1 ea. Push Plate, J300, 100mm x 404mm x 1.3mm
1 ea. Pull Plate, J400, 100mm x 404mm x 1.3mm
1 ea. Kick Plate, J106, 4mm clear plastic
1 ea. Wall Stop, L02251

HW-C4

3 pr. Hinges, A1111
1 ea. Dead Lock, E8221
2 ea. Pull, J401
1 ea. Cylinder, E19211
2 ea. Push Bar, J501
2 ea. Flush Bolts, L14081
2 ea. Closers, C02041

2 ea. Kick Plates, J106, 4mm clear plastic
2 ea. Overhead Stop, C04541
1 ea. Threshold, Bronze
2 sets. Weatherstripping

HW-C5

3 pr. Hinges, A1111
2 ea. Pull, J401
2 ea. Push Bar, J501
2 ea. Flush Bolts, L14081
2 ea. Closers, C02041
2 ea. Kick Plates, J106, 4mm clear plastic
2 ea. Overhead Stop, C04541

HW-C6

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F04
1 ea. Closer, C02011
1 ea. Wall Stop, L02251

HW-C7

3 pr. Hinges, A2111
1 ea. Lockset, F01
1 ea. Padlock, P01, Grade 4, Options B and G
1 ea. Hasp, A83351
2 sets Weatherstripping
2 ea. Rain Drip
2 ea. Threshold, J36130
1 ea. Dust Proof Strike, L04011
2 ea. Flush Bolts, L14081
2 ea. O.H. Holder, C08511

HW-C8

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F04
1 ea. Closer, C02021
1 ea. Kick Plates, J106, 4mm clear plastic
1 ea. Wall Stop, L02251
1 set Weatherstripping
1 ea. Rain Drip
1 ea. Threshold, Bronze

HW-C9 Hardware By Door Manufacturer

HW-C10

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F05
1 ea. Wall Stop, L02251

HW-C11

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F04
1 ea. Closer, C02011
1 ea. Wall Stop, L02251

HW-C12

3 pr. Hinges, A8111
1 ea. Lockset, F07
1 ea. Closer, C02011
1 pr. Flush Bolts, L14251
1 ea. Dust Proof Strike, L04021
2 ea. Kickplates, J106, 4mm clear plastic
2 ea. Wall Stop, L02251

HW-C13

1-1/2 pr. Hinges, A8112
1 ea. Lockset, F05
1 ea. Closer, C02021
1 ea. Wall Stop, L02251

HW-C14

1-1/2 pr. Hinges, A8112
1 ea. Lockset, F01
1 ea. Floor Stop, L02131

HW-C15

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F04
1 ea. Closer, C02021
1 ea. Wall Stop, L02251

***** SAFETY PAYS *****

BATTALION HEADQUARTERS BUILDINGS (7076, 7077, 7081 and 7084) "D"

HW-D1

1-1/2 pr.	Hinges, A8111
1 ea.	Lockset, F05 (Room 130 only)
1 ea.	Lockset, F07 (Room 142 only)
1 ea.	Lockset, F14 (Janitor Closets only)
1 ea.	Closer, C02011
1 ea.	Kick Plate, J106, 4mm clear plastic
1 ea.	Wall Stop, L02251

HW-D2

1-1/2 pr.	Hinges, A8111
1 ea.	Lockset, F19
1 ea.	Wall Stop, L02251

HW-D3

1-1/2 pr.	Hinges, A8111
1 ea.	Closer, C02011
1 ea.	Push Plate, J300, 100mm x 404mm x 1.3mm
1 ea.	Pull Plate, J400, 100mm x 404mm x 1.3mm
1 ea.	Kick Plate, J106, 4mm clear plastic
1 ea.	Wall Stop, L02251

HW-D4

3 pr.	Hinges, A1111
1 ea.	Dead Lock, E8221
2 ea.	Pull, J401
1 ea.	Cylinder, E19211
2 ea.	Push Bar, J501
2 ea.	Flush Bolts, L14081
2 ea.	Closers, C02041
2 ea.	Kick Plates, J106, 4mm clear plastic
2 ea.	Overhead Stop, C04541
1 ea.	Threshold, Bronze
2 sets.	Weatherstripping

HW-D5

3 pr.	Hinges, A1111
2 ea.	Pull, J401
2 ea.	Push Bar, J501
2 ea.	Flush Bolts, L14081
2 ea.	Closers, C02041
2 ea.	Kick Plates, J106, 4mm clear plastic
2 ea.	Overhead Stop, C04541

HW-D6

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F04
1 ea. Closer, C02011
1 ea. Wall Stop, L02251

HW-D7

3 pr. Hinges, A2111
1 ea. Lockset, F01
1 ea. Padlock, P01, Grade 4, Options B and G
1 ea. Hasp, A83351
2 sets Weatherstripping
2 ea. Rain Drip
2 ea. Threshold, J36130
1 ea. Dust Proof Strike, L04011
2 ea. Flush Bolts, L14081
2 ea. O.H. Holder, C08511

HW-D8

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F04
1 ea. Closer, C02021
1 ea. Kick Plates, J106, 4mm clear plastic
1 ea. Wall Stop, L02251
1 set Weatherstripping
1 ea. Rain Drip
1 ea. Threshold, Bronze

HW-D9 Hardware By Door Manufacturer

HW-D10

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F05
1 ea. Wall Stop, L02251

HW-D11

3 pr. Hinges, A8111
1 ea. Lockset, F07
1 ea. Closer, C02011
1 pr. Flush Bolts, L14251
1 ea. Dust Proof Strike, L04021
2 ea. Kickplates, J106, 4mm clear plastic
2 ea. Wall Stop, L02251

HW-D12

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F05
1 ea. Closer, C02011
1 ea. Wall Stop, L02251

HW-D13

3 pr. Hinges, A8111
1 ea. Lockset, F01
1 pr. Flush Bolts, L14251
1 ea. Dust Proof Strike, L04021

HW-D14

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F04
1 ea. Closer, C02021
1 ea. Wall Stop, L02251

HW-D15

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F04
1 ea. Closer, C02011
1 ea. Wall Stop, L02251

HW-D16

1-1/2 pr. Hinges, A8111
1 ea. Lockset, F01
1 ea. Closer, C02011
1 ea. Wall Stop, L02251

DINING FACILITY (7048) “E”

HW-E1

3 pr. Hinges, A1111, 639
1 ea. Dead Lock, E8221, 612
2 ea. Pull, J401, 612
1 ea. Cylinder, E19211, 612
2 ea. Push Bar, J501, 612
2 ea. Flush Bolts, L14081, 612
2 ea. Closers, C02041, 691
2 ea. Kick Plates, J106, 4mm clear plastic
1 ea. Wall Stop, L02251, 612
1 ea. Threshold, Bronze
2 sets. Weatherstripping

HW-E2

3 pr.	Hinges, A1111, 639
1 ea.	Dead Lock, E8221, 612
1 ea.	Cylinder, E19211, 612
2 ea.	Pull, J401, 612
2 ea.	Push Bar, J501, 612 b
2 ea.	Flush Bolts, L14081, 612
2 ea.	Closers, C02041, 691
2 ea.	Kick Plates, J106, 4mm clear plastic
2 ea.	Overhead Stop, C04541, 612

HW-E3

1-1/2 pr.	Hinges, A1111
1 ea.	Pull, J401, Dark Bronze Anodized
1 ea.	Push Bar, J501, Dark Bronze Anodized
1 ea.	Closer, C02081
1 ea.	Kick Plates, J106, 4mm clear plastic
1 ea.	Dead Lock, E8221
1 ea.	Cylinder, E19211
1 ea.	Wall Stop, L02251, 612

HW-E4

2 pr.	Hinges, A8111, 114 mm x 127 mm, 639
1 ea.	Lockset, F05, 612
1 ea.	Closer, C02011, 691
1 ea.	Wall Stop, L02251, 612

HW-E5

1 1/2 pr.	Hinges, A2111, 639
1 ea.	Lockset, F04, 612
1 ea.	Wall Stop, L02251, 612
1 set	Weatherstripping
1 ea.	Threshold, J36130

HW-E6

1-1/2 pr.	Hinges, A8111, 639
1 ea.	Lockset, F07, 612
1 ea.	Closer, C02011, 691
1 ea.	Wall Stop, L02251, 612
2 ea.	Armor Plate, J101

HW-E7

1-1/2 pr.	Hinges, A8111, 639
1 ea.	Lockset, F14, 612
1 ea.	Closer, C02021, 691
1 ea.	Kickplate, J106, 4mm Clear Plastic

HW-E8

1 ea.	Dead Lock, E8221, 612
1 ea.	Cylinder, E19211, 612
3 pr.	Spring Hinges, K81041
2 ea.	Flush Bolts, L14081, 612
4 ea.	Armor Plate, J101, strainless Steel
4 ea.	Push Plate, J301, stainless Steel
4 ea.	Door Bumper, Series 170, stainless steel, by Bommer or equal

HW-E9

1-1/2 pr.	Hinges, A8111, 639
1 ea.	Closer, C02011, 691
1 ea.	Push Plate, J300, 100mm x 404mm x 1.3mm, 612
1 ea.	Pull Plate, J400, 100mm x 404mm x 1.3mm, 612
1 ea.	Kick Plate, J106, 4mm clear plastic
1 ea.	Wall Stop, L02251, 612

HW-E10

1-1/2 pr.	Hinges, A8111, 639
1 ea.	Closer, C02011, 691
1 ea.	Lockset, F14, 612
1 ea.	Wall Stop, L02251, 612

HW-E11

2 ea.	Overhead Closers, C05061, 691
2 ea.	Pivot set, C07021, 639
2 ea.	Flush Bolts, L14081, 612
1 ea.	Dead Lock, E8221, 612
1 ea.	Cylinders, E19211, 612
2 ea.	Threshold, bronze
4 ea.	Armor Plate, J101, stainless steel
4 ea.	Push Plate, J301, stainless steel
4 ea.	Door Bumper, Series 170, stainless steel, by Bommer or equal
1 set	Weatherstripping

HW-E12

1-1/2 pr. Hinges, A2111, 639
1 ea. Lockset, F04, 612
1 set Weatherstripping
1 ea. Rain Drip
1 ea. Threshold, J36130

HW-E13

1-1/2 pr. Hinges, A2111, 639
1 ea. Lockset, F01, 612
1 ea. Padlock, P01, Grade 4, Options B and G
1 ea. Hasp, A83351
1 set Weatherstripping
1 ea. Rain Drip
1 ea. Threshold, J36130
1 ea. O.H. Holder, C08511, 691

HW-E14

3 pr. Hinges, A2111, 639
1 ea. Lockset, F01, 612
1 ea. Padlock, P01, Grade 4, Options B and G
1 ea. Hasp, A83351
2 sets Weatherstripping
2 ea. Rain Drip
2 ea. Threshold, J36130
1 ea. Dust Proof Strike, L04011, 612
2 ea. Flush Bolts, L14081, 612
2 ea. O.H. Holder, C08511, 691

HW-E15

2 ea. Flush Bolts, L14081, 612
1 ea. Dead Lock, E8221, 612
1 ea. Cylinders, E19211, 612
4 ea. Armor Plate, J101, stainless steel
4 ea. Push Plate, J301, stainless steel
4 ea. Door Bumper, Series 170, stainless steel, by Bommer or equal
3 pr. Spring Hinges, K81041

HW-E16

1-1/2 pr. Hinges, A8112, 639
1 ea. Lockset, F05, 612
1 ea. Overhead Stop, L01541, 612

HW-E17

1-1/2 pr. Hinges, A8112
1 ea. Lockset, F05
1 ea. Wall Stop, L02251

HW-E18

1 ea. Hinges, A8111, 639
1 ea. Lockset, F01, 612
1 ea. Wall Stop, L02251, 612

HW-E19

1-1/2 pr. Hinges, A8111, 639
1 ea. Closer, C02021, 691
1 ea. Lockset, F07, 612
1 ea. Wall Stop, L02251, 612

HW-E20

1-1/2 pr. Hinges, A8111, 639
1 ea. Closer, C02021, 691
1 ea. Push Plate, J300, 4"x16"x.050, 612
1 ea. Pull Plate, J400, 4"x16"x.050, 612
2 ea. Armor Plate, J101, stainless steel
1 ea. Wall Stop, L02251, 612

HW-E21

3 pr. Hinges, A1111, 639
2 ea. Pull, J401, 612
2 ea. Push Bar, J501, 612
1 ea. Dead Lock, E8221, 612
1 ea. Cylinders, E19211, 612
2 ea. Flush Bolts, L14081, 612
2 ea. Closers, C02041, 691
2 ea. Kick Plates, J106, 4mm clear plastic
2 ea. Threshold, Bronze
2 sets. Weatherstripping

HW-E22 Hardware By Door Manufacturer

HW-E23

1 ea. Dead Lock, E8221, 612
1 ea. Cylinder, E19211, 612
3 pr. Spring Hinges, K81041
4 ea. Armor Plate, J101, strainless Steel
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***** SAFETY PAYS *****

4 ea. Push Plate, J301, stainless Steel
2 ea. Wall Stop, L02251, 612

HW-E24

1-1/2 pr. Hinges, A8111, 639
1 ea. Lockset, F01, 612
1 ea. Padlock, P01, Grade 4, Options B and G
1 ea. Hasp, A83351
1 ea. Wall Stop, L02251, 612

FIELD FOOD SERVICE STORAGE FACILITY (7052) “F”

HW-F1

3 pr. Hinges, A1111, 639
1 ea. Lockset, F08, 612
2 ea. Flush Bolts, L14081, 612
2 ea. Kick Plates, J102, 1.27mm, 612
2 ea. Door Holder and Keeper, L01291, 612
1 ea. Dust Proof Strike, L04021, 612
2 ea. Bottom Sweep, 612

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 08700
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO.	TRANS-MITTAL NO.	ITEM NO.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER	REV-IEW-ER	SUBMIT	APPROV. NEEDED BY	MATER. NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
a.	b.	c.	d. through q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Hardware and Accessories; FIO.										
			SD-07 Schedules										
		2	Hardware Schedule; GA.										
		3	Keying Schedule; GA.										
			SD-13 Certificates										
		4	Hardware and Accessories; FIO.										
			SD-19 Operation and Maintenance Manuals										
		5	Hardware and Accessories; FIO.										

SECTION 08810

GLASS AND GLAZING
12/93

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SAFETY PAYS

SECTION 08810

GLASS AND GLAZING
12/93

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTES (ANSI)

ANSI Z97.1	1984; R 1994) Safety Performance Specifications and Methods of Tests for Safety Glazing Materials Used in Buildings Elastomeric Joint Sealants

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 920	(1995) Elastomeric Joint Sealants
ASTM C 1036	(1991) Flat Glass
ASTM C 1048	(1992) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM C 1172	(1996) Laminated Architectural Flat Glass
ASTM E 152	(1981a) Fire Tests of Door Assemblies
ASTM E 163	(1984) Fire Tests of Window Assemblies
ASTM E 773	(1988) Seal Durability of Sealed Insulating Glass Units
ASTM E 774	(1992) Sealed Insulating Glass Units
ASTM E 1300	(1994) Determining the Minimum Thickness and Type of Glass Required to Resist a Specific Load

CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1201	Safety Standard for Architectural Glazing Materials

FLAT GLASS MARKETING ASSOCIATION (FGMA)

FGMA-01 (1990) Glazing Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1992) Fire Doors and Windows

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Glass; GA.

Glazing Accessories; GA.

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions for all glass types.

SD-04 Drawings

Glazing Materials and Accessories; GA.

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass, for all glass types.

SD-13 Certificates

Glass; FIO.

Certificates stating that the glass meets the specified requirements. Labels or marking affixed to the glass will be accepted in lieu of certificates.

SD-14 Samples

Glass; GA.

Two 305 x 305 mm samples of each of the following: insulating glass units.

1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Glazed panels shall comply with the safety standards, as indicated in accordance with ANSI Z97.1. Glazed panels

shall comply with indicated wind/snow loading in accordance with ASTM E 1300.

1.4 DELIVERY, STORAGE AND HANDLING

Glazing compounds shall be delivered to the site in the manufacturer's unopened containers. Glass shall be stored indoors in a safe, well ventilated dry location in accordance with manufacturer's instructions, and shall not be unpacked until needed for installation. Glass shall not be stored on site over 1 month.

1.5 PROJECT/SITE CONDITIONS

Glazing work shall not be started until outdoor temperature is above 5 degrees C and rising, unless procedures recommended by glass manufacturer and approved by Contracting Officer are made to warm the glass and rabbet surfaces. Ventilation shall be provided to prevent condensation of moisture on glazing work during installation. Glazing work shall not be performed during damp or raining weather.

1.6 WARRANTY

1.6.1 Insulating Glass

Manufacturer shall warrant the insulating glass to be free of fogging or film formation on the internal glass surfaces caused by failure of the hermetic seal for a period of 10 years from Date of Substantial Completion. Warranty shall be signed by manufacturer.

PART 2 PRODUCTS

2.1 FLOAT GLASS

2.1.1 Clear Annealed Glass

Annealed glass shall be Type I transparent flat type, Class 1 - clear, Quality q3 - glazing select, conforming to ASTM C 1036. Where not otherwise indicated, 3 mm thick glazing with 90 percent light transmittance, 1.00 percent shading coefficient, shall be provided for openings up to and including 21 square feet; 5 mm thick glazing with 90 percent light transmittance, 0.99 percent shading coefficient, shall be provided for openings over 21 square feet but not over 36 square feet; 8 mm thick glazing with 88 percent light transmittance, 0.94 percent shading coefficient, shall be provided for openings over 36 square feet but not over 45 square feet

2.1.2 Tinted (Light-Reducing) Glass

Tinted (light-reducing) glass shall be Type I transparent flat type, Class 3-tinted, 6 mm thick, Quality q3 - glazing select 49 percent light transmittance, 0.59 shading coefficient, conforming to ASTM C 1036. Color shall be tinted light bronze.

2.2 ROLLED GLASS

2.2.1 Patterned Glass

Patterned glass shall be Type II flat type. Class 1 - translucent, Finish f1 - patterned one side, Quality q7 -

decorative, random pattern p3, conforming to ASTM C 1036. Color shall be clear. Patterned glass is a component of tinted insulating glass as specified in glass designated type G-2 for building #6768 and 6770 only.

2.2.2 NOT USED

2.3 INSULATING GLASS

Insulating glass shall be Class A preassembled units of dual-seal construction consisting of lites of glass separated by an aluminum spacer and 12 mm dehydrated space conforming to ASTM E 773 and ASTM E 774. Aluminum spacer shall be roll-formed, with bent or tightly soldered joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into air space through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone. Glass types shall be as follows:

2.3.1 Laminated Insulating Glass

Glass for two-pane insulating units shall be laminated Type I annealed glass, Class 1 - clear, Quality q3 - glazing select conforming to ASTM C 1036. Glass performance shall be Value/Winter Nighttime 2.8.

2.3.2 Laminated Low-E Insulating Glass

Exterior glass panes for Low-E insulating units shall be laminated Type I annealed flat glass, Class 2 - tinted with anti-reflective low-emissivity coating on No. 2 surface (inside surface of exterior pane), Quality q3 - glazing select, conforming to ASTM C 1036. Glass performance shall be K-q3 - glazing select, conforming to ASTM C 1036. Glass performance shall be K-Value/Winter Nighttime 1.9, shading coefficient 0.55. Color shall be bronze.

2.4 HEAT-TREATED GLASS

2.4.1 Tempered Glass

Tempered glass shall be kind FT fully tempered transparent flat type; Class 1 - clear, Condition A uncoated surface, Quality q3 - glazing select, .89 percent light transmittance, 0.98 percent shading coefficient conforming to ASTM C 1048, color shall be clear or Class 2 - tinted, Condition A uncoated surface, Quality q3 - glazing select, 44 percent light transmittance, .55 percent shading coefficient conforming to ASTM C 1048. Color shall be bronze.

2.5 LAMINATED GLASS

Laminated glass shall consist of two layers of Type I transparent float glass, Class 1 - clear or 2 - tinted Quality q3 - glazing select, conforming to ASTM C 1036. Glass shall be bonded together with 0.76 mm thick PVB plastic interlayer under pressure, conforming to requirements of 16 CFR 1201 and ASTM C 1172. Color shall be as shown.

2.6 SPANDREL GLASS

2.6.1 Ceramic-Opacified Spandrel Glass

Ceramic-opacified spandrel glass shall be kind HS heat-strengthened transparent flat type, Condition B, coated

with a colored ceramic material on No. 2 surface, Quality q3 - glazing select, conforming to ASTM C 1048. Glass performance shall be K-Value/Winter Nighttime 1.09, shading coefficient .65. Color shall be bronze.

2.7 MIRRORS

2.7.1 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear, Glazing Quality q1 6.4 mm thick conforming to ASTM C 1036. Glass color shall be clear. Glass shall be coated with silver coating, copper protective coating, and mirror backing paint conforming to ASTM C 1036. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 6.4 mm thick glass, free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint applied, and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication. Provide mirrors above vanity. Coordinate with other mirrors provided in Section 10800 TOILET ACCESSORIES.

2.7.2 Mirror Accessories

2.7.2.1 Mastic

Mastic for setting mirrors shall be a polymer type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Mastic shall be compatible with mirror backing paint, and shall be approved by mirror manufacturer.

2.7.2.2 Mirror Frames

Mirrors shall be provided with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames shall be 31.8 x 6.4 x 6.4 mm continuous at top and bottom of mirrors. Concealed fasteners of type to suit wall construction material shall be provided with mirror frames.

2.7.2.3 Mirror Clips

Concealed fasteners of type to suit wall construction material shall be provided with clips.

2.8 LEADED GLASS

2.8.1 Glass

Glass is to be rolled (cathedral), blown (antique), prismatic (beveled), or any combination.

2.8.2 Cames

Cames are to be lead, brass and/or zinc. Widths are to be as determined by the design.

2.8.3 Reinforcing Bars

Reinforcing bars are to be zinc or brass. The bars are to be located within the panel, to be visually unobtrusive, and shall extend to the perimeter of the panel, secured to the perimeter cames of the panel. They shall be 3.2 mm thick and 9.5 mm, 12.7 mm or 19 mm wide.

2.8.4 Cement

The cement shall be composed of glazing puuy made pliable with a solvent and shall contain japan drier. This fis to fill the channels of the cames, sealing the glass. The cement is to be either gray or black.

2.8.5 Soldier

The solder shall be either 50/50 or 60/40 (tin/lead) and uses in conjunction with a flux.

2.9 GLAZING ACCESSORIES

2.9.1 Preformed Tape
Preformed tape shall be elastomeric rubber extruded into a ribbon of a width and thickness suitable for specific application. Tape shall be of type which will remain resilient, have excellent adhesion, and be chemically compatible to glass, metal, or wood.

2.9.2 Sealant

Sealant shall be elastomeric conforming to ASTM C 920, Type S or M, Grade NS, Class 12.5, Use G, of type chemically compatible with setting blocks, preformed sealing tape and sealants used in manufacturing insulating glass. Color of sealant shall be as shown on the Finish Schedule.

PART 3 EXECUTION

3.1 PREPARATION

Openings and framing systems scheduled to receive glass shall be examined for compliance with approved shop drawings, FGMA-01 and glass manufacturer's recommendations including size, squareness, offsets at corners, presence and function of weep system, face and edge clearance requirements and effective sealing between joints of glass-framing members. Detrimental materials shall be removed from glazing rabbet and glass surfaces and wiped dry with solvent. Glazing surfaces shall be dry and free of frost.

3.2 INSTALLATION

Glass and glazing work shall be performed in accordance with approved shop drawings, FGMA-01, glass manufacturer's instructions and warranty requirements. Glass shall be installed with factory labels intact and removed only when instructed. Wired glass shall be installed in accordance with NFPA 80. Edges and corners shall not be ground, nipped or cut after leaving factory. Springing, forcing or twisting of units during installation will not be permitted.

3.3 LEADED GLASS

The glass panels will be constructed of individual pieces of glass and are to be glazed with standard glazing techniques and materials. If their is protective glass on the exterior of the leaded glass, there shall be vent holes to the exterior to allow air circulation and to minimize condensation. These holes shall have a non-organic filter to prevent dust and insects from entering the space between the glass panels. The glass shall be free of any visible cracks. The glass shall be completely captured by the cames of lead with no daylight. The glass shall be assembled with the smooth side on each piece facing in the same direction. The intersection of the cames shall be soldered with smooth, even, and consistant solder joints. The glass panels are to be flat. The glass panels are to withstand normal wind pressure. The reinforcing bars are affixed to prevent buckling of the glass panel. The glass panels are to be sealed to prevent water leakage.

3.4 CLEANING

Upon completion of project, outside surfaces of glass shall be washed clean and the inside surfaces of glass shall be washed and polished in accordance with glass manufacturer's recommendations. Leaded glass shall be cleaned of cement, flux and oil residue.

3.5 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 08810
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Glass; GA.										
		2	Glazing Accessories; GA.										
			SD-04 Drawings										
		3	Glazing Materials and Accessories; GA.										
			SD-13 Certificates										
		4	Glass; FIO.										
			SD-14 Samples										
		5	Glass; GA.										

SAFETY PAYS

SECTION 09250

GYPSUM WALLBOARD
01/94

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SAFETY PAYS

SECTION 09250

GYPSUM WALLBOARD
01/94

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 580	(1995a) Stainless Steel Wire
ASTM A 853	(1993) Steel Wire, Carbon, for General Use
ASTM B 164	(1993) Nickel-Copper Alloy Rod Bar, and Wire
ASTM C 36	(1996) Gypsum Wallboard
ASTM C 79	(1995) Gypsum Sheathing Board
ASTM C 442	(1992) Gypsum Backing Board and Coreboard
ASTM C 475	(1994) Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C 514	(1996) Nails for the Application of Gypsum Board
ASTM C 557	(1993a) Adhesive for Fastening Gypsum Wallboard to Wood Framing
ASTM C 630	(1996a) Water-Resistant Gypsum Backing Board
ASTM C 645	(1996a) Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board
ASTM C 754	(1996) Installation of Steel Framing Members to Receive Screw-Attached Gypsum
ASTM C 840	(1996) Application and Finishing of Gypsum Board
ASTM C 931	(1995a) Exterior Gypsum Soffit Board

ASTM C 955	(1996a) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Track), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases
ASTM C 1002	(1996a) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases
ASTM C 1278	(1995) Fiber-Reinforced Gypsum Panels

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P8016	(1993) Specification Tested Products Guide

GYPSUM ASSOCIATION (GA)

GA 600	(1994) Fire Resistance Design Manual

UNDERWRITERS LABORATORIES (UL)

UL-Fire Resistance Dir	(1995) Fire Resistance Directory

1.2 SYSTEM DESCRIPTION

1.2.1 Fire-Rated Construction

Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL requirements, and as required to meet pressurization requirements. Penetrations through rated partitions and ceilings shall be sealed tight with rated firestopping materials. Coordinate firestopping with Section 07270 FIRESTOPPING. Fire ratings shall be as indicated.

1.2.2 Pressurized Enclosures

Pressurized fire-rated gypsum board enclosures shall allow the mechanical and electrical life-safety systems to operate in accordance with the design intent. Air pressure within stair shaft shall be 240 Pa. Maximum mid-span deflection shall be L/360.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-04 Drawings

Steel Framing; FIO.

Control Joints; FIO.

Fire-Resistant Assemblies; FIO.

Drawings and installation details for ceiling framing, furring, special wall framing, and framed openings in walls and ceilings.

SD-13 Certificates

Gypsum Wallboard; FIO.

Water-Resistant Gypsum Board; FIO.

Exterior Gypsum Soffit Board; FIO.

Fiber Reinforced Gypsum Board; FIO.

Cementitious Backer Units; FIO.

Steel Framing; FIO.

Certificates stating that the steel framing and gypsum wallboard meet the specified requirements.

1.4 QUALIFICATIONS

Manufacturer shall specialize in manufacturing the types of material specified and shall have a minimum of 10 years of documented successful experience. Installer shall specialize in the type of gypsum board work required and shall have a minimum of 5 years of documented successful experience.

1.5 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered in original containers bearing the name of manufacturer, contents, and brand name. Materials shall be stored off the ground in a weathertight structure for protection. Gypsum boards shall be stacked flat, off floor and supported to prevent sagging and warpage. Adhesives and joint materials shall be stored in accordance with manufacturer's printed instructions. Damaged or deteriorated materials shall be removed from jobsite.

1.6 ENVIRONMENTAL CONDITIONS

Environmental conditions for application and finishing of gypsum board shall be in accordance with ASTM C 840. During the application of gypsum board without adhesive, a room temperature of not less than 4 degrees C shall be maintained. During the application of gypsum board with adhesive, a room temperature of not less than 10 degrees C shall be maintained for 48 hours prior to application and continuously afterwards until completely dry. Building spaces shall be ventilated to remove water not required for drying joint treatment materials. Drafts shall be avoided during dry hot weather to prevent materials from drying too rapidly.

PART 2 MATERIALS

2.1 NON-LOADBEARING STUD WALLS

2.1.1 Studs

Studs for non-loadbearing walls shall conform to ASTM C 645. Studs shall be prefabricated 0.084 mm thick steel, C-shaped, punched web for utility access, G60 hot-dip galvanized after fabrication, or truss-designed studs fabricated of 1.519 mm thick steel angles with a single No. 7 gauge rod forming an open-web truss-like pattern between flanges with all points contact welded.

2.1.2 Runner Tracks

Floor and ceiling runner tracks shall conform to ASTM C 645. Tracks shall be prefabricated, U-shaped with minimum 22 mm flanges, unpunched web, gauge to match studs, G60 hot-dip galvanized after fabrication.

2.2 LOADBEARING STUD WALLS

2.2.1 Studs

Studs for loadbearing walls shall conform to ASTM C 955. Studs shall be prefabricated, C-shaped with minimum 32 mm high flanges, punched web for utility access, 1.519 mm thick steel, G60 hot-dip galvanized after fabrication.

2.2.2 Runner Tracks

Floor and ceiling runner tracks shall conform to ASTM C 955. Runners shall be prefabricated, U-shaped with minimum 22 mm flanges, unpunched web, thickness to match studs, G60 hot-dip galvanized after fabrication.

2.2.3 Bridging

Bridging for loadbearing walls shall conform to ASTM C 955. Bridging shall be minimum 19 mm high by 19 mm deep cold-rolled steel channel with weld attachment clips at each stud or V-bar type weld or screw attached to each stud flange. Bridging shall be adequate to provide lateral support for the stud.

2.3 SUSPENDED CEILING FRAMING

Main carrying channels and cross furring members for suspended gypsum board ceilings shall conform to ASTM C 645. Carrying channels shall be formed from 1.519 mm thick cold-rolled steel, hot-dipped galvanized after fabrication, 38 by 19 mm deep. Furring members shall be formed from cold-rolled steel, hot-dip galvanized after fabrication, 19 mm high by 19 mm deep.

2.4 GYPSUM BOARD

Gypsum board shall have square-cut ends, tapered or beveled edges and shall be maximum possible length.

2.4.1 Standard Gypsum Board

Regular gypsum board shall conform to ASTM C 36, and shall be 1200 mm wide.

2.4.2 Fire-Rated Gypsum Board

Provide fire-rated gypsum board complying with ASTM C 36, Type X, 1200 mm wide.

2.4.3 Water-Resistant Gypsum Board

Water-resistant gypsum board shall conform to ASTM C 630, regular, with water-resistant paper faces, paintable surfaces, and shall be 1200 mm width and maximum permissible length.

2.4.4 Gypsum Sheathing Board

Gypsum backing board shall conform to ASTM C 442, regular and Type X, 1200 mm wide. Backing board shall have aluminum foil vapor retarder laminated to back surface.

2.4.5 Foil-Backed Gypsum Board

Foil-backed gypsum board shall conform to ASTM C 36, regular, 1200 mm wide. Gypsum board shall have aluminum foil vapor retarder laminated to back surface.

2.4.6 Exterior Gypsum Soffit Board

Exterior gypsum soffit board shall conform to ASTM C 931, regular, 1200 mm wide.

2.4.7 Exterior Sheathing Board

Exterior sheathing board shall conform to ASTM C 79, Type X, shall have water-resistant core, water-repellant paper faces each side, tongue-and-groove edges, and shall be 1200 mm wide. Provide in thickness indicated.

2.4.8 Fiber Reinforced Gypsum Board

Fiber Reinforced Gypsum (FRG), very highy impact board shall conform to ASTM C-1278. Board shall be Type X fire rated 1200 mm wide.

2.5 ACCESSORIES

2.5.1 Taping and Embedding Compound

Taping and embedding compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use in embedding tape at gypsum wallboard joints and fastener heads, and shall be compatible with tape and substrate.

2.5.2 Finishing or Topping Compound

Finishing or topping compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use as a finishing compound for gypsum board.

2.5.3 All-Purpose Compound

All-purpose compound shall be specifically formulated and manufactured to use as a taping and finishing compound, and shall be compatible with tape and substrate.

2.5.4 Joint Tape

Joint tape shall conform to ASTM C 475 and shall be as recommended by gypsum board manufacturer.

2.5.5 Nails

Nails shall conform to ASTM C 514. Nails shall be hard-drawn low or medium-low carbon steel, suitable for intended use. Special nails for predecorated gypsum board shall be as recommended by predecorated gypsum board manufacturer.

2.5.6 Screws

Screws shall conform to ASTM C 1002. Screws shall be self-drilling and self-tapping steel, Type S for wood or light-gauge steel framing.

2.5.7 Adhesives

Adhesives shall conform to ASTM C 557. Adhesives shall be formulated to bond gypsum board to wood framing members. For securing gypsum board to metal framing, adhesive shall be as recommended by gypsum board manufacturer.

2.5.8 Hangers

Suspended ceiling runner channel hangers shall be soft, annealed steel wire not less than 4 mm nominal diameter, conforming to ASTM A 853 or flat iron or steel straps, at least 2 by 22 mm size, coated with zinc, cadmium, or rust-inhibiting paint.

2.5.9 Fastenings

Tie wire, clips, rings, and other fastenings shall be corrosion-resisting steel conforming to ASTM A 580, composition 302, 304, or 316, Condition A, or nickel-copper alloy conforming to ASTM B 164, Class A or B, annealed condition, except that walls, partitions, and other vertical surfaces not incorporated in ceiling construction may be erected with soft, annealed steel conforming to ASTM A 853.

2.5.9.1 Tie Wire

Tie wire for constructing partitions and vertical furring, for securing metal lath to supports, and for lacing shall be not less than 1.2 mm diameter. Tie wire for other applications shall be not less than 1.6 mm diameter.

2.5.9.2 Clips

Clips used in lieu of tie wire for securing the furring channels to the runner channels in ceiling construction shall be made from strip not less than 3 mm thick or shall be hairpin clip, formed of wire not less than 0.4 mm nominal diameter. Other clips and rings or fastenings of similar materials shall be equivalent in holding power to that provided by tie wire for the specific application.

2.5.9.3 Control Joints

One-piece control joint formed with V-shaped slot and removable strip covering slot opening.

2.5.10 Accessories

ASTM C 1047, Cornerbeads, edge trim, and control (expansion) joints shall be corrosion protective coated steel designed for the intended use. Flanges shall be free of dirt, grease, and other materials that may adversely affect the bond of joint treatment.

PART 3 EXECUTION

3.1 INTERIOR WALL FRAMING

Steel framing and furring members shall be installed in accordance with ASTM C 754. Members shall be in alignment with spacings not to exceed the maximum spacings indicated on drawings. Runners shall be aligned accurately at the floor and ceiling and securely anchored.

3.1.1 Wall Openings

The framing system shall provide for the installation and anchorage of the required subframes or finish frames for wall openings at doors, pass-through openings, and access panels. Partitions abutting continuous suspended ceilings shall be strengthened for rigidity at rough openings of more than 750 mm wide. Studs at openings shall be 0.912 mm thick minimum bare metal thickness and spot grouted at jamb anchor inserts. Double studs shall be fastened together with screws and secured to floor and overhead runners. Two studs placed back-to-back shall be used for framing solid-core doors, doors over 900 mm wide and extra-heavy doors such as X-ray room doors.

3.1.2 Wall Control Joints

Control joints for expansion and contraction shall be constructed with double studs installed 13 mm apart in interior walls or wall furrings where indicated on drawings, but shall not exceed 9 mm between control joints. Ceiling-height door frames may be used as vertical control joints. Door frames of less than ceiling height may be used as control joints only if standard control joints extend to ceiling from both corners of top of door frame. Control joints between studs shall be filled with firesafing insulation.

3.2 SUSPENDED CEILING FRAMING

Suspended ceiling system framing shall be installed in accordance with ASTM C 754.

3.2.1 Hangers

Hangers shall be spaced not more than 1200 mm along runner channels and 900 mm in the other direction or 1050 mm in both directions unless otherwise indicated. Locations of hanger wires shall be coordinated with other work. Hangers at ends of runner channels shall be located not more than 150 mm from wall. Hanger wire shall be looped around bottom chord of open-web steel joists, structural steel members, or center I-beam clamps with three full turns around itself. Sags or twists which develop in the suspended system shall be adjusted. Damaged or

faulty parts shall be replaced.

3.2.2 Main Runners

Main runner channels shall be installed in accordance with ASTM C 754. Hanger wires shall be double strand saddle-tied to runner channels and the ends of hanger wire shall be twisted three times around itself. Main runners shall be located to within 150 mm of the paralleling wall to support the ends of cross furring. Main runners shall not come in contact with abutting masonry or concrete walls. Where main runners are spliced, ends shall be overlapped 300 mm with flanges of channels interlocked, and shall be securely tied at each end of splice with wire looped twice around the channels.

3.2.3 Furring Channels

Furring channels shall be spaced in accordance with ASTM C 754. Furring channels shall be secured to the runner channels and to structural supports at each crossing with tie wire, hairpin clips, or equivalent fastenings. Furring channels shall be located within 50 mm of parallel walls and beams, and shall be cut 13 mm short of abutting walls.

3.2.4 Ceiling Openings

Support members shall be provided as required at ceiling openings for access panels, recessed light fixtures, and air supply or exhaust. Support members shall be not less than 38 mm main runner channels and vertically installed suspension wires or straps shall be located to provide at least the minimum support specified herein for furring and wallboard attachment. Intermediate structural members not a part of the structural system, shall be provided for attachment or suspension of support members.

3.2.5 Light Fixtures

Light fixtures shall not be supported directly from suspended ceiling runners. Hanger wires for recessed or surface mounted light fixtures shall be anchored to structure at four corners of light fixtures, and additional wires shall be provided at appropriate locations to carry the weight of light fixtures.

3.2.6 Control Joints

Control joints for expansion and contraction shall be located in accordance with ASTM C 840, and in locations indicated on drawings, and shall not exceed 230 square meters in area nor more than 15 m in either direction.

3.3 APPLICATION OF GYPSUM BOARD

Gypsum board shall be installed in accordance with ASTM C 840 and as specified. Edges and ends of gypsum boards shall be cut to obtain neat fitting joints. End joints of adjoining boards shall be staggered, and shall be staggered on opposite sides of wall. Boards shall be applied with moderate contact without forcing in place. Holes for pipes, fixtures or other small openings shall be cut with a tool which will provide a neat fit. Screws shall be driven so that the heads are slightly below the plane of paper face. Fracturing the paper face or damaging the core shall be avoided. Trim shall be installed at external and internal angles formed by the intersecting gypsum board surfaces with other surfaces. Corner beads shall be installed to vertical and horizontal corners in accordance with manufacturer's published instructions.

3.3.1 Two-Ply Gypsum Board

Second layer of gypsum board shall be applied perpendicular to first layer with joints staggered and secured with mechanical fasteners. The use of adhesive shall be in accordance with ASTM C 840.

3.3.2 Foil-Backed Gypsum Sheathing Board

Foil-backed fire rated gypsum sheathing board shall be placed with foil barrier up. Secure to deck with screws (8) per board. Tape screw heads and seams.

3.3.3 Adhesively-Applied Gypsum Board

Walls scheduled to receive adhesively-applied gypsum board shall be dry, free of dust, oil, or form release agents, protrusions or voids, or foreign matter that would affect a proper bond.

3.3.4 Backing Board

Gypsum board and water-resistant gypsum backing board used as a substrate to receive ceramic tile shall be in accordance with ASTM C 840, System X.

3.3.5 Fiber Reinforced Gypsum (FRG)

Fiber Reinforced gypsum board shall be in accordance with ASTM-C-1278 as dry, free of dust, oil, secured with mechanical fasteners. The use of adhesive shall be in accordance with ASTM C 840.

3.4 TAPING AND FINISHING

Gypsum board taping and finishing shall be performed in accordance with ASTM C 840. Boards shall be kept free of dirt, oil and other foreign matter that could cause a lack of bond. Screw heads, dents, gouges, and cut-outs shall be filled with joint compound and sanded. Accessories at exposed joints, edges, corners, openings, and similar locations shall be taped, floated with joint compound, and sanded to produce surfaces ready for gypsum board finishes.

3.5 FIRE-RESISTANT ASSEMBLIES

Gypsum wallboard construction for fire-rated assemblies shall be in accordance with UL-05, FM P8016 or GA 600 for the design number indicated on drawings.

3.6 PATCHING

Surface defects and damage shall be corrected as required to leave gypsum board smooth, uniform in appearance, and ready to receive finish as specified.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 09250
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-04 Drawings										
		1	Steel Framing; FIO.										
		2	Control Joints; FIO.										
		3	Fire-Resistant Assemblies; FIO.										
			SD-13 Certificates										
		4	Gypsum Wallboard; FIO.										
		5	Water-Resistant Gypsum Board; FIO.										
		6	Exterior Gypsum Soffit Board; FIO.										
		7	Fiber Reinforced Gypsum Board; FIO.										
		8	Cementitious Backer Units; FIO.										
		9	Steel Framing; FIO.										

SAFETY PAYS

SECTION 09310

CERAMIC AND QUARRY TILE
10/94

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SAFETY PAYS

SECTION 09310

CERAMIC AND QUARRY TILE
10/94

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1A	(1992) Installation of Ceramic Tile in the Wet Set Method, with Portland Cement Mortar
ANSI A108.1B	(1992) Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar
ANSI A108.4	(1992) Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive
ANSI A108.5	(1992) Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
ANSI A108.10	(1992) Installation of Grout in Tilework
ANSI A108.11	(1992) Interior Installation of Cementitious Backup Units
ANSI A118.1	(1992) Dry-Set Portland Cement Mortar
ANSI A118.3	(1992) Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive
ANSI A118.4	(1992) Latex-Portland Cement Mortar
ANSI A118.6	(1992) Ceramic Tile Grouts
ANSI A118.9	(1992) Test Methods and Specifications for Cementitious Backer Units

ANSI A118.10	(1993) Load Bearing, Bonded Water-proof Membranes for Thinset Ceramic Tile and Dimension Stone Installations
ANSI A136.1	(1992) Organic Adhesives for Installation of Ceramic Tile
ANSI A137.1	(1988) Ceramic Tile

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185	(1994) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM C 33	(1993) Concrete Aggregates
ASTM C 144	(1993) Aggregate for Masonry Mortar
ASTM C 150	(1996) Portland Cement
ASTM C 206	(1984; R 1992) Finishing Hydrated Lime
ASTM C 207	(1991; R 1992) Hydrated Lime for Masonry Purposes
ASTM C 241	(1990) Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C 373	(1988) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
ASTM C 648	(1984; R 1989) Breaking Strength of Ceramic Tile
ASTM C 847	(1995) Metal Lath
ASTM C 1026	(1987; R 1996) Measuring Frost Resistance of Ceramic Tile to Freeze-Thaw Cycling
ASTM C 1027	(1984; R 1990) Determining Visible Abrasion Resistance of Glazed Ceramic Tile
ASTM C 1028	(1996) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

MARBLE INSTITUTE OF AMERICA (MIA)

MIA-01 (1991) Design Manual IV Dimensional Stone

TILE COUNCIL OF AMERICA (TCA)

TCA-01 (1998) Handbook for Ceramic Tile Installation

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Tile; FIO.

Mortar, Grout, and Adhesive; FIO.

Manufacturer's catalog data.

SD-06 Instructions

Tile; FIO.

Mortar and Grout; FIO.

Manufacturers preprinted installation and cleaning instructions.

SD-13 Certificates

Tile; FIO.

Mortar, Grout, and Adhesive; FIO.

Certificates indicating conformance with specified requirements. A master grade certificate shall be furnished for tile.

SD-14 Samples

Tile; GA.

Accessories; GA.

Marble Thresholds; GA.

Samples of sufficient size to show color range, pattern, type and joints.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover.

1.4 ENVIRONMENTAL REQUIREMENTS

Ceramic tile work shall not be performed unless the substrate and ambient temperature is at least 10 degrees C and rising. Temperature shall be maintained above 10 degrees C while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used they shall be vented to the outside to avoid carbon dioxide damage to new tilework.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

PART 2 PRODUCTS

2.1 TILE

Tile shall be standard grade conforming to ANSI A137.1. Containers shall be grade sealed. Seals shall be marked to correspond with the marks on the signed master grade certificate. Tile shall be impact resistant with a minimum breaking strength for wall tile of 41 kg and 113 kg for floor tile in accordance with ASTM C 648. Tile for cold climate projects shall be rated frost resistant by the manufacturer as determined by ASTM C 1026. Water absorption shall be 0.5 maximum percent in accordance with ASTM C 373. Floor tile shall have a minimum static coefficient of friction of 0.5 in accordance with ASTM C 1028. Tile shall be Class III as rated by the manufacturer when tested in accordance with ASTM C 1027 for abrasion resistance as related to foot traffic.

2.1.1 Mosaic Tile

Ceramic mosaic tile and trim shall be unglazed natural clay with cushion edges, porcelain unpolished with sharply formed face. Tile size and color shall be as indicated on the color schedule drawings.

2.1.2 Quarry Tile

Quarry tile and trim shall be unglazed with abrasive grain surface. Tile size and color shall be as indicated on the color schedule drawings.

2.1.3 Glazed Wall Tile

Glazed wall tile and trim shall be cushion edged with bright or matte glaze. Wall tile for barracks buildings shall be 50 mm x 50 mm. Tile size and color shall be as indicated on the color schedule drawings.

2.1.4 Porcelain Pavers

Porcelain pavers and trim shall be unglazed with unpolished surface. Tile color and size shall be as indicated on

the color schedule drawings. Porcelain paver base for area “B” (Soldier Community Building) shall be cut tile of same material as floor, cut to 100 mm high. Corners shall be cut to fit.

2.1.5 Not UsedGlazed Paver Tile

Glazed paver tile shall be flat, impervious natural clay. Tile size shall be 200 by 200 mm by 7.94 mm thick, plain face with cushion edges. Color shall be as indicated.

2.1.6 Accessories

Barracks building accessories shall be the built-in type of the same materials and finish as the wall tile. Accessories shall include, but are not limited to the following: cap, cove, nosing, soap dish/grab bar, towel bar, corners, bullnose or transition trim. Transitions for the Barracks building shall be metal (solid brass extrusion) protective edge trim in the locations shown on the drawings. Size and color shall be as indicated.

2.2 SETTING-BED

The setting-bed shall be composed of the following:

2.2.1 Aggregate for Concrete Fill

Aggregate shall conform to ASTM C 33. Maximum size of coarse aggregate shall not be greater than one-half the thickness of concrete fill.

2.2.2 Portland Cement

Cement shall conform to ASTM C 150, Type I, white for wall mortar and gray for other uses.

2.2.3 Sand

Sand shall conform to ASTM C 144.

2.2.4 Hydrated Lime

Hydrated lime shall conform to ASTM C 206, Type S or ASTM C 207, Type S.

2.2.5 Metal Lath

Metal lath shall be flat expanded type conforming to ASTM C 847, and weighing not less than 1.4 kg/square meter.

2.2.6 Reinforcing Wire Fabric

Wire fabric shall conform to ASTM A 185. Wire shall be either 50 by 50 mm mesh, 16/16 wire or 38 by 50 mm mesh, 16/13 wire.

2.3 WATER

Water shall be potable.

2.4 MORTAR, GROUT, AND ADHESIVE

Mortar, grout, and adhesive shall conform to the following:

2.4.1 Dry-Set Portland Cement Mortar

ANSI A118.1.

2.4.2 Latex-Portland Cement Mortar

ANSI A118.4.

2.4.3 Organic Adhesive

ANSI A136.1, Type I.

2.4.4 Epoxy Resin Grout

ANSI A118.3.

2.4.5 Cementitious Backer Board

Cementitious backer units shall comply with ANSI A118.9.

2.5 MARBLE THRESHOLDS

Marble thresholds shall be of size required by drawings or conditions. Marble shall be Group A as classified by MIA-01. Marble shall have a fine sand-rubbed finish and shall be white or gray in color as approved by the Contracting Officer. Marble abrasion shall be not less than 12.0 when tested in accordance with ASTM C 241.

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Surface to receive tile shall be inspected and shall conform to the requirements of ANSI A108.1A or ANSI A108.1B for surface conditions for the type setting bed specified and for workmanship. Variations of surface to be tiled shall fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	3 mm in 2.4 meters	3.0 mm in 3 meters
Organic Adhesives	3 mm in 2.4 meters	1.5 mm in 1 meters
Latex portland cement mortar	3 mm in 2.4 meters	3.0 mm in 3 meters
Epoxy	3 mm in 2.4 meters	3.0 mm in 3 meters

3.2 GENERAL INSTALLATION REQUIREMENTS

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile in colors and patterns indicated shall be applied in the area shown on the drawings. Tile shall be installed with the respective surfaces in true even planes to the elevations and grades shown. Special shapes shall be provided as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases and coves shall be solidly backed with mortar.

3.3 INSTALLATION OF WALL TILE

Wall tile shall be installed in accordance with the TCA-01, by the following methods:

W-223 for solid backing or wood studs in dry or limited water exposure;
W-202 for solid backing in wet areas;
W-242 for metal studs in dry or limited water exposure;
W-244 for wood or metal studs in wet areas;
B-412 for wood or metal studs in tub areas;
B-415 for wood or metal studs in wet areas.

3.3.1 Dry-Set Mortar and Latex-Portland Cement Mortar (Wet Areas)

Dry-set or Latex-portland cement shall be used to install tile in accordance with ANSI A108.5. Latex portland cement shall be used when installing porcelain ceramic tile.

3.3.2 Organic Adhesive (Dry Areas)

Organic adhesive installation of ceramic tile shall conform to ANSI A108.4.

3.4 INSTALLATION OF FLOOR TILE

Floor tile shall be installed in accordance with TCA-01, by the following methods:

F-122 for thin set over concrete floor;
F-121 for cement mortar bed over concrete floor;
TR611 for marble thresholds;
B-415 for shower receptors;

Brass trasitions for the Barracks Building shall be installed by the following method:

1. Press the perforated anchoring leg of the trim into the adhesive and align.
2. Trowel tile adhesive over the anchoring leg.
3. Solidly embed the tiles so that the surface of the tile is level with the top of the trim or slightly lower (1mm).
4. Leave a joint between the tile and the trim of 1 mm minimum to 3 mm maximum. Completely fill this joint with grout.

3.4.1 Workable or Cured Mortar Bed (Shower Stalls)

Floor tile shall be installed over a workable mortar bed or a cured mortar bed at the option of the Contractor. Workable mortar bed materials and installation shall conform to ANSI A108.1A. Cured mortar bed and materials shall conform to ANSI A108.1B. Joints between quarry tile shall be between 6.35 mm and 9.53 mm in width and shall be uniform in width.

3.4.2 Dry-Set and Latex-Portland Cement (Areas Except Shower Stalls)

Dry-set or Latex-portland cement mortar shall be used to install tile directly over properly cured, plane, clean concrete slabs in accordance with ANSI A108.5. Latex portland cement shall be used when installing porcelain ceramic tile.

3.4.3 Ceramic Tile Grout

Ceramic Tile grout shall be prepared and installed in accordance with ANSI A108.10.

3.4.4 Waterproofing

Shower pans are specified in Section 15400 PLUMBING, GENERAL PURPOSE. Waterproofing for built-up membranes, single-ply membranes and reinforced liquid applied membranes shall be in accordance with ANSI A118.10 and manufacturer's recommendation.

3.4.5 Concrete Fill

Concrete fill shall be composed by volume of 1 part portland cement to 3 parts fine aggregate to 4 parts coarse aggregate, and mixed with water to as dry a consistency as practicable. The fill shall be spread, tamped, and screeded to a true plane, and pitched to drains or leveled as shown. Concrete fill shall be thoroughly damp cured before application of setting-bed material . Concrete fill shall be reinforced with one layer of reinforcement, with the uncut edges lapped the width of one mesh and the cut ends and edges lapped not less than 50 mm. Laps shall be tied together with 1.3 mm wire every 250 mm along the finished edges and every 150 mm along the cut ends and edges. The reinforcement shall be supported and secured in the centers of concrete fills. The mesh shall be continuous; except where expansion joints occur, mesh shall be cut and discontinued across such joints. Reinforced concrete fill shall be provided under the setting-bed where the distance between the under-floor surface and the finished tile floor surface is 50 mm or greater, and shall be of such thickness that the mortar setting-bed over the concrete fill shall be not less than 19 mm nor more than 31 mm thick at any point.

3.4.6 Cementitious Backer Board

Cementitious backer units shall be installed in accordance with ANSI A108.11.

3.5 INSTALLATION OF MARBLE THRESHOLDS

Thresholds shall be installed where indicated in a manner similar to that of the ceramic tile floor. Thresholds shall be the full width of the opening. Head joints at ends shall not exceed 6 mm in width and shall be grouted full as specified for ceramic tile.

3.6 CONTROL JOINTS

Joints shall be formed as indicated and sealed as specified in Section 07920 CAULKING AND SEALANTS.

3.6.1 Walls

Control joints shall be provided at control joints in backing material. Wherever backing material changes, a control joint shall be formed to separate the different materials.

3.6.2 Floors

Control joints shall be provided over construction joints, control joints, and expansion joints in concrete slabs. Control joints shall also be provided where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 7.2 to 10.8 m each way in large interior floor areas and 3.6 to 4.8 m each way in large exterior areas or areas exposed to direct sunlight or moisture. Expansion joints shall extend through setting-beds and fill.

3.7 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a noncorrosive soap or other approved method of protection. Tiled floor areas shall be covered with building paper before foot traffic is permitted over the finished tile floors. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen. Damaged or defective tiles shall be replaced.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 09310
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Tile; FIO.										
		2	Mortar, Grout, and Adhesive; FIO.										
			SD-06 Instructions										
		3	Tile; FIO.										
		4	Mortar and Grout; FIO.										
			SD-13 Certificates										
		5	Tile; FIO.										
		6	Mortar, Grout, and Adhesive; FIO.										
			SD-14 Samples										
		7	Tile; GA.										
		8	Accessories; GA.										
		9	Marble Thresholds; GA.										

SAFETY PAYS

SECTION 09510

ACOUSTICAL CEILINGS
04/95

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SECTION 09510

ACOUSTICAL CEILINGS
04/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 635	(1995) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636	(1996) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM E 1264	(1990) Standard Classification for Acoustical Ceiling Products
ASTM E 1414	(1991a) Standard Test for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.

UNDERWRITERS LABORATORIES (UL)

UL-05	(1996) Fire Resistance Directory

1.2 GENERAL REQUIREMENTS

Acoustical treatment shall consist of sound controlling units mechanically mounted on a ceiling suspension system. The unit size, texture, finish, and color shall be as specified. The Contractor has the option to substitute English inch-pound (soft metric) recessed light fixtures (RLF) for hard metric recessed light fixtures. English inch-pound acoustical ceiling tile systems; including acoustical ceiling tiles, recessed light fixtures, air diffusers, air registers and grills; shall be provided with English inch-pound recessed light fixtures, provided that they do not interfere with other design requirements. All other criteria contained in this specification applies to both hard metric and English inch-pound acoustical tile systems. For additional guidance see specification Section 01030 METRIC MEASUREMENTS. The location and extent of acoustical treatment shall be as shown on the drawings.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL

PROCEDURES:

SD-01 Data

Acoustical Ceiling System; GA.

Metal Pan Ceiling System; GA.

Luminous Ceiling System; GA

Manufacturer's descriptive data and installation instructions.

SD-04 Drawings

Acoustical Ceiling System; GA.

Metal Pan Ceiling System; GA.

Luminous Ceiling System; GA

Drawings shall show suspension system, method of anchoring and fastening, details, and reflected ceiling plan.

Ceiling Attenuation Class and Test; GA.

Test reports by an independent testing laboratory attesting that acoustical ceiling systems meet specified fire endurance and sound transmission requirements. Data attesting to conformance of the proposed system to Underwriters Laboratories, Inc. requirements for the fire endurance rating listed in UL-05 may be submitted in lieu of test reports.

SD-14 Samples

Acoustical Units; GA.

Metal Pan Ceiling System; FIO.

Luminous Ceiling System; GA

Two samples of each type of acoustical unit, metal panel and each type of suspension grid tee section and metal pan suspension system showing texture, finish, and color.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed to assure temperature and moisture conditions.

1.5 ENVIRONMENTAL REQUIREMENTS

A uniform temperature of not less than 16 degrees C nor more than 27 degrees C and a relative humidity of not more than 70 percent shall be maintained before, during, and after installation of acoustical units.

1.6 SCHEDULING

Interior finish work such as plastering, concrete and terrazzo work shall be complete and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

Acoustical units shall conform to ASTM E 1264, Class A, and the following requirements:

2.1.1 Units for Exposed-Grid System

2.1.1.1 Acoustical Units (Battalion HQ, Brigade HQ, Company Operations and Barracks)

Type: III.
NRC grade: 55 minimum when tested on mounting No. 7.
Pattern: b.
Nominal size: 600 by 600 mm.
Edge detail: Reveal edge.
Finish: Factory-applied white paint finish.
LR grade: 1.
CAC range: 40-44.

2.1.1.2 Acoustical Units (Dining Facility Only)

Type: IX
NRC grade: .65-.75.
Pattern: c.
Nominal size: 600 by 600 mm.
Edge detail: Reveal edge.
Finish: Factory-applied white smooth painted finish.
LR grade: 1.
CAC range: 35-39.

2.1.3 Metal Pans

Ceiling pans shall be linear, 0.6 mm smooth aluminum, 82.5 mm wide face, 19 mm deep vertical legs with edges formed for attaching to carrier support system on 101 mm on centers, factory finished as indicated on the drawings. Ceiling pans shall have butt-cut ends for splice plate. Splice plate shall be aluminum, finished to match pans; formed for snap fit in butt-cut pan ends. Support system shall be 1 mm aluminum with factory finished matte black baked enamel paint finish. Accessories shall be provided to make a complete installation. Colors and patterns for metal panel units and suspension system components shall be as shown on the finish schedule.

2.1.4 Luminous Diffusers

Luminous diffusers shall be flat matte white acrylic units pre-cut to the correct size by the manufacturer.

2.2 SUSPENSION SYSTEM

2.2.1 Acoustical Suspended System

Suspension system shall be standard, exposed-grid, standard width flange, and shall conform to ASTM C 635 for heavy-duty systems. Surfaces exposed to view shall be aluminum or steel with factory-applied white baked-enamel finish. Wall molding shall have a flange of not less than 23 mm and shall be provided with outside corner caps. Inside corner caps shall be provided where, due to the configuration of the installation, they are needed to produce a workmanlike appearance.

2.2.2 Luminous Diffuser System

Suspension system shall be a special design connected together to form a suspended exposed-grid ceiling above the serveries. Surfaces exposed to view shall be aluminum or steel with factory-applied baked-enamel finish as selected on finish schedule. Wall molding shall have a finish to match the exposed grid. Inside corner caps shall be provided where, due to the configuration of the installation, they are needed to produce a workmanlike appearance. Supporting grid members shall be fabricated so that no field cutting is required by the installing contractor.
Luminous Ceiling System shall be USG “Skylite” or equal. (800 USG 4YOU)

2.3 HANGERS

Hangers shall be galvanized steel wire. Hangers and attachment shall support a minimum 1330 N ultimate vertical load without failure of supporting material or attachment. Hangers shall meet all requirements specified in Section 13080 SEISMIC PROTECTION FOR MECHANICAL, ELECTRICAL EQUIPMENT, for suspended ceiling assemblies.

2.4 ACCESS PANELS

Access panels shall match adjacent acoustical units and shall be designed and equipped with suitable framing and fastenings for removal and replacement without damage. Panel shall be not less than 300 by 300 mm or more than 300 by 600 mm. An identification plate of 0.8 mm thick aluminum, 19 mm in diameter, stamped with the letters "AP" and finished the same as the unit, shall be attached near one corner on the face of each access panel.

2.5 FINISHES

Acoustical units, metal pans and suspension system members shall have manufacturer's standard textures, patterns

and finishes as specified. Ceiling suspension system components shall be treated to inhibit corrosion.

2.6 CEILING ATTENUATION CLASS AND TEST

Ceiling attenuation class (CAC) range of acoustical units, when required, shall be determined in accordance with ASTM E 1414. Test ceiling shall be continuous at the partition and shall be assembled in the suspension system in the same manner that the ceiling will be installed on the project. System shall be tested with all acoustical units installed.

PART 3 EXECUTION

3.1 INSTALLATION

Acoustical work shall be provided complete with necessary fastenings, clips, and other accessories required for a complete installation. Mechanical fastenings shall not be exposed in the finished work. Hangers shall be laid out for each individual room or space. Hangers shall be placed to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At least two main runners shall be provided for each ceiling span. Wherever required to bypass an object with the hanger wires, a subsuspension system shall be installed, so that all hanger wires will be plumb.

3.1.1 Suspension System

Suspension system shall be installed in accordance with ASTM C 636 and as specified herein. There shall be no hanger wires or other loads suspended from underside of steel decking.

3.1.1.1 Plumb Hangers

Hangers shall be plumb and shall not press against insulation covering ducts and pipes.

3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, the resulting horizontal force shall be offset by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Wall molding shall be provided where ceilings abut vertical surfaces. Wall molding shall be secured not more than 75 mm from ends of each length and not more than 400 mm on centers between end fastenings. Wall molding springs shall be provided at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Acoustical units shall be installed in accordance with the approved installation instructions of the manufacturer. Edges of acoustical units shall be in close contact with metal supports, with each other, and in true alignment. Acoustical units shall be arranged so that units less than one-half width are minimized. Units in exposed-grid system shall be held in place with manufacturer's standard hold-down clips, if units weigh less than 5 kg per

square m or if required for fire resistance rating.

3.2 CEILING ACCESS PANELS

Ceiling access panels shall be located directly under the items which require access.

3.3 METAL CEILING PANELS

Ceiling panels shall be installed in accordance with manufacturers recommendations. Ceiling pans shall be protected from damage from time of installation until acceptance.

3.4 LUMINOUS CEILING

Grid and diffuser units shall be installed so there is no light leak between the grid connections or between the grid and diffuser panels visible from below.

3.4 CLEANING

Following installation, dirty or discolored surfaces of acoustical units shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

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TITLE AND LOCATION				CONTRACTOR									SPEC. SECTION 09510	
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ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. PROCEDURES:										
			SD-01 Data										
		1	Acoustical Ceiling System; GA.										
		2	Metal Pan Ceiling System; GA. Luminous Ceiling System; GA.										
			SD-04 Drawings										
		4	Acoustical Ceiling System; GA.										
		5	Metal Pan Ceiling System; GA.										
		6	Ceiling Attenuation Class and Test; GA. Luminous Ceiling System; GA.										
			SD-14 Samples										
		8	Acoustical Units; GA.										
		9	Metal Pan Ceiling System; GA.										
		10	Luminous Ceiling System; GA.										

SECTION 09650

RESILIENT FLOORING
07/96

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SAFETY PAYS

SECTION 09650

RESILIENT FLOORING
07/96

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 224	(1989) Smooth Surface Asphalt Roof Roofing (Organic Felt)
ASTM D 412	(1997) Rubber Properties in Tension
ASTM D 624	(1991) Rubber Property - Tear Resistance, Test Method For
ASTM D 746	(1979) Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 2240	(1997) Rubber Property - Durometer Hardness
ASTM D 4078	(1992; R 1996) Water Emulsion Floor Polish
ASTM E 648	(1997) Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Source
ASTM E 662	(1994a) Specific Optical Density of Smoke Generated by Solid Materials
ASTM F 1303	(1996) Sheet Vinyl Floor Covering with Backing
ASTM F 1344	(1993) Rubber Floor Tile

FEDERAL SPECIFICATIONS (FS)

FS RR-T-650	(Rev D) Treads, Metallic and Nonmetallic, Skid Resistant
FS SS-T-312	(Rev B; Int Am 1; Notice 1) Tile, Floor: Asphalt, Rubber, Vinyl Vinyl-Asbestos
FS SS-W-40	(Rev A; Int Am 1; Notice 1) Wall Base: Rubber, and Vinyl Plastic

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Resilient Flooring and Accessories; FIO.

Manufacturer's descriptive data and installation instructions. Cleaning and maintenance instructions shall be included.

SD-09 Reports

Resilient Flooring and Accessories; GA.

Copies of test reports showing that representative product samples of the flooring proposed for use have been tested by an independent testing laboratory within the past year and conform to the requirements specified.

SD-14 Samples

Resilient Flooring and Accessories; GA.

Three samples of each indicated color and type of flooring, edge strip and base including rubber tile/stair treads. Sample size shall be minimum 75 mm by 125 mm.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers, shall be stored in a clean dry area with temperature maintained above 21 degrees C for 2 days prior to installation, and shall be stacked according to manufacturer's recommendations.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas to receive resilient flooring shall be maintained at a temperature above 21 degrees C for 2 days before application, during application and 2 days after application. A minimum temperature of 13 degrees C shall be maintained thereafter.

1.5 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

1.6 EXTRA MATERIALS

Extra flooring material shall be furnished at the rate of one carton for each tile color and pattern installed. Extra

materials shall be from the same lot as those installed. Extra base material composed of 6 m of each color shall be furnished. Extra materials shall be labelled identifying project number, buildings and rooms where used.

PART 2 PRODUCTS

2.1 VINYL-COMPOSITION TILE

Vinyl-composition tile shall conform to ASTM F 1066, Class 2, (through pattern tile), Composition 1, asbestos-free, and shall be 300 mm square and 3.2 mm thick. Tile shall have the color and pattern uniformly distributed throughout the thickness of the tile. Flooring in any one continuous area shall be from the same lot and shall have the same shade and pattern. Color and pattern shall be as indicated.

2.2 RESILIENT LINOLEUM TILE

Resilient linoleum tile shall conform to FS SS-T-312. Linoleum tile with backing shall be homogeneous tile linoleum of natural materials consisting of linseed oil, cork, wood flour, rosin binders, dry pigments, mixed and calendered onto man-made backing and complying with the following physical characteristics:

Composition: Homogeneous, natural material with color and pattern throughout total thickness of entire tile material.
Size: 508 mm by 508 mm and 330 mm by 330 mm, where indicated on the drawings and color schedule.
Gauge: 2.54 mm.
Slip Resistance: 0.6 for flat surfaces, for compliance with Americans With Disabilities Act (ADA) of 1990 per manufacturer's testing criteria.
Smoke Density: 450 or less (ASTM E 662)Critical Radiant
Flux: Class 1 Rating (ASTM E 648)

Patterns and colors as indicated on drawings.

2.3 WEIGHT ROOM RUBBER ATHLETIC FLOORING

2.3.1 Tiles

Weight room rubber athletic flooring shall be interlocking, non-adhered, molded top quality solid rubber tiles, 610 mm square and 11 mm thick, with 5 interlocks per side. Tiles shall weigh approximately 5 kg each.

2.3.2 Properties

2.3.2.1 Tensile Strength

650 psi per ASTM D 412.

2.3.2.2 Durometer Shore A Test

55 +/- 5 per ASTM D 224.

2.3.2.3 Elongation

550 percent per ASTM D 412.

2.3.2.4 Tear Resistance

75 PPI per ASTM D 624.

2.3.2.5 Temperature Stability Range

49 degrees C per ASTM D 746.

2.3.2.6 Shrinkage

Not to exceed 2 percent after 7 days @ 100 degrees C per ASTM D 412.

2.3.2.7 Flammability

Critical radiant flux of 0.577 watts/cm when tested per ASTM E 648.

2.3.2.8 Smoke Density

Smoldering rate of 113 and flaming mode of 537 per ASTM E 662.

2.3.2.9 Conductivity

Non-conductive.

2.3.3 Color

Color shall be as indicated on the color scedule drawings.

2.4 STAIR TREADS, RISERS, AND STRINGERS

Treads, risers, and stringers shall conform to FS RR-T-650 composition A, (rubber with Durometer hardness of 90 with +/- 5 tested in accordance with ASTM D 2240)). Design shall be either a one piece nosing/tread/riser or a two piece nosing/tread with a matching coved riser. Installation shall include stringer angles on both the wall and banister sides, and landing trim. Surface of treads shall be low raised stud or ribbed pattern. Color and pattern shall be as indicated on the color schedule drawings.

2.5 RESILIENT BASE

Base shall conform to FS SS-W-40, Type I (rubber). Style A, (straight)-installed with carpet. Style B, (coved)-installed with resilient flooring. Base shall be 102 mm high and a minimum 3 mm thick. Job Formed corners shall be furnished. Color shall be as indicated.

2.6 TRANSITION STRIP

Edge strip shall be vinyl, 25 mm wide, and of thickness to match the flooring. Color shall blend with adjacent flooring colors unless otherwise indicated.

2.7 ADHESIVE

Adhesive for flooring and wall base shall be as recommended by the flooring manufacturer.

2.8 POLISH

Polish shall conform to ASTM D 4078.

PART 3 EXECUTION

3.1 EXAMINATION/VERIFICATION OF CONDITIONS

The Contractor shall verify that site conditions are in agreement with the design package and shall report all conditions that will prevent a proper installation. The Contractor shall not take any corrective action without written permission from the Government.

3.2 SURFACE PREPARATION

Flooring shall be in a true, level plane, except where indicated as sloped. Before any work under this section is begun, all defects such as rough or scaling concrete, low spots, high spots, and uneven surfaces shall have been corrected, and all damaged portions of concrete slabs shall have been repaired as recommended by the flooring manufacturer. Concrete curing compounds, other than the type that does not adversely affect adhesion, shall be entirely removed from the slabs.

3.3 BOND AND MOISTURE TEST

The suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content shall be determined by a moisture and bond test as recommended by the flooring manufacturer. A bond test should also be used to determine the compatibility of resilient flooring adhesives to concrete floors after removal of all surface treatments. Follow procedures for testing as recommended by the flooring manufacturer.

3.4 INSTALLATION OF VINYL-COMPOSITION TILE, RUBBER TILE, LINOLEUM TILE AND WEIGHT ROOM FLOORING

Tile flooring shall be installed with adhesive in accordance with the manufacturer's installation instructions. Tile lines and joints shall be kept square, symmetrical, tight, and even. Each floor shall be in a true, level plane, except where indicated as sloped. Edge width shall vary as necessary to maintain full-size tiles in the field, but no edge tile shall be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Edge tile shall be cut, fitted, and scribed to walls and partitions after field flooring has been applied. Vinyl composition tile shall be quarter turned unless noted otherwise. Weight room athletic rubber tiles shall be installed without adhesives over substrate according to the manufacture’s recommended method of installation.

3.5 INSTALLATION OF RUBBER TREADS AND RISERS

Stair treads and risers shall be installed with adhesive in accordance with the manufacturer's installation instructions. Treads and risers as shall cover the full width of the stairs.

3.6 INSTALLATION OF EDGE STRIPS

Edge strips shall be secured with adhesive as recommended by the manufacturer. Edge strips shall be provided at locations where flooring termination is higher than the adjacent finished flooring, except at doorways where thresholds are provided.

3.7 INSTALLATION OF RESILIENT BASE

Wall base shall be installed with adhesive in accordance with the manufacturer's instructions. Base joints shall be tight and base shall be even with adjacent resilient flooring.

3.8 CLEANING

Immediately upon completion of installation of tile in a room or an area, flooring and adjacent surfaces shall be cleaned to remove all surplus adhesive. No sooner than 5 days after installation, flooring shall be washed with a nonalkaline cleaning solution, rinsed thoroughly with clear cold water, and, except for raised pattern flooring, given two coats of polish. After each polish coat, floors shall be buffed to an even luster with an electric polishing machine. Raised pattern rubber flooring shall be cleaned and maintained as recommended by the manufacturer.

3.9 PROTECTION

From the time of laying until acceptance, flooring shall be protected from damage. Flooring which becomes damaged, loose, broken, or curled shall be removed and replaced.

--END OF SECTION--

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SECTION 09680

CARPET
07/92

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SECTION 09680

CARPET
07/92

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 16	(1993) Test Method: Colorfastness to Light
AATCC 134	(1991) Test Method: Electrostatic Propensity of Carpets
AATCC 165	(1993) Test Method: Colorfastness to Crocking: Carpets - AATCC Crockmeter Method
AATCC 174	(1993) Test Method: Antimicrobial Activity Assesssment of Carpet

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 418	(1993) Pile Yarn Floor Covering Construction
ASTM D 1335	(1967; R 1972) Tuft Bind of Pile Floor Coverings
ASTM D 3936	(1980) Delamination Strength of Secondary Backing of Pile Floor Coverings
ASTM E 648	(1997) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CARPET AND RUG INSTITUTE (CRI)

CRI 104	(1996) Commercial Carpet Installation Standard

CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1630	Standard for the Surface Flammability of Carpet and Rugs

GERMANY INSTITUTE FOR STANDARDIZATION (DEUTSCHES INSTITUTE FURNORMUNG) (DIN)

DIN 54318	(1986) Machine-Made Textile Floor Coverings; Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions; Identical with Iso 2551 Edition 1981

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Carpet and Accessories; FIO.

For each type of carpet material and installation accessory required, catalog data and printed documentation stating physical characteristics, durability, resistance to fading and flame resistance characteristics.

SD-04 Drawings

Installation; FIO.

Layout drawings indicating areas receiving carpet, direction of pile, location of seams, and locations of edge molding.

SD-06 Instructions

Carpet and Accessories; FIO.

Three copies of the manufacturer's printed installation instructions for the carpet, including procedures for installation, preparation of substrate, seaming techniques, and recommended adhesives and tapes.

SD-09 Reports

Moisture Tests; FIO.

Test reports of moisture content of concrete slab stating date of test, person conducting the test, and the area tested.

SD-13 Certificates

Carpet and Accessories; FIO.

Certificates of compliance from a laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards and Technology attesting that each type of carpet and cushion material conforms to the standards specified.

SD-14 Samples

Carpet and Accessories; GA.

a. Carpet: Two "Production Quality" samples 675 by 450 mm for broadloom carpet, 450 by 450 mm for carpet tiles, of each carpet proposed for use, showing quality, pattern, and color specified.

b. Vinyl Moldings: Two pieces of each type at least 300 mm long.

SD-19 Operation and Maintenance Manuals

Carpet and Accessories; FIO.

Three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Materials shall be stored in a clean, dry, well ventilated area, protected from damage and soiling, and maintained at a temperature above 16 degrees C for 2 days prior to installation.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas in which carpeting is to be installed shall be maintained at a temperature above 16 degrees C for 2 days before installation, during installation, and for 2 days after installation. A minimum temperature of 13 degrees C shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 45 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

1.6 EXTRA MATERIAL

Extra material from same dye lot consisting of full width continuous broadloom and uncut carpet tiles shall be provided for maintenance. A minimum of 3 percent of total square meters of each carpet type, pattern, and color shall be provided to Contracting Officer, labeled with building and room numbers where used.

PART 2 PRODUCTS

2.1 PHYSICAL REQUIREMENTS FOR BROADLOOM CARPET

Carpet shall be first quality; free of visual blemishes, streaks, poorly dyed areas, and other physical and manufacturing defects. Carpet materials and treatments shall be reasonably nonallergenic and free of other recognized health hazards.

2.2 PHYSICAL REQUIREMENTS FOR CARPET TILE

Provide carpet tile of tufted, or vertical fusion bonded construction with a secondary backing of fiberglass reinforced vinyl composite. Provide carpet tile of first quality and free of visual blemishes, streaks, poorly dyed areas, and other physical and manufacturing defects. Carpet tile shall be of the modular type, identical in size, 457 mm by 457 mm plus or minus 0.4 mm, precision die cut for complete interchangeability. Sides shall be straight and the corners square. Tufts shall be firmly secured at the edges as in the other areas of the carpet tile. Carpet tile must lay flat on a flat surface without curling, warping, buckling, cupping, or doming and without any lumpiness, unevenness, or differences in thickness in individual tiles or from tile-to-tile. Provide carpet tile that does not stretch or shift position in use when installed according to the carpet tile manufacturer's instructions. Use nontoxic carpet tile materials and treatment, free from other recognized health hazards, and conforming to the following types.

2.2.1 Carpet Types

2.2.1.1 Carpet, Type-A (Level Loop)

Carpet shall comply with the following:

(a) Carpet Fabrication: Tufted.

(b) Category: Broadloom with 0.15 percent growth/shrink rate in accordance with DIN 54318.

(c) Pile Type: Level loop.

(d) Pile Fiber: Branded commercial nylon continuous filament, soil protection and static control.

(e) Pile or Wire Height: 4.75 mm.

(f) Gauge: 39.4/10 cm

(g) Stitches and Tufts: 43.7/ 10 cm.

(h) Surface Pile Yarn Weight, (or Face Weight): .882 kg per square meter. This does not include weight of backings. Weight of actual surface yarn exposed to wear above carpet backing shall be determined in accordance with ASTM D 418.

(i) Pile Density: 7256, as determined using the formula below:

Density = (26)(36)/.129

W is pile yarn weight in ounces per square yard and T is pile thickness in inches. Pile thickness shall be determined in accordance with ASTM D 418.

(j) Dye Method:

Yarn (or Skein) dyed - yarn dyed before being fabricated into carpet.

(k) Backing Materials: Primary backing materials shall be those customarily used and accepted by the trade for each type of carpet, polypropylene. Secondary backing to suit project requirements shall be those customarily used and accepted by the trade for each type of carpet, except when a special unitary back designed for gluedown is provided.

(l) Width: 3.6 m minimum usable carpet.

(m) Pattern, texture, and color: As indicated on color schedule drawings.

2.2.1.2 Carpet Type - B (Textured)

Carpet shall comply with the following:

(a) Carpet Fabrication: Tufted.

(b) Category: Broadloom with 0.15 percent growth/shrink rate in accordance with DIN 54318.

(c) Pile Type: Level-loop.

(d) Pile Fiber: Branded commercial nylon continuous filament, soil protection and static control.

(e) Pile or Wire Height: 4.8 mm.

(f) Gauge: 31.5 /10cm.

(g) Surface Pile Yarn Weight, (or Face Weight): 881.66 gm/m2. This does not include weight of backings. Weight of actual surface yard exposed to wear above carpet backing shall be determined in accordance with ASTM D 418.

(i) Pile Density: 6282 as determined using the formula below:

Density = (26) (36) /.149

W is pile yarn weight in ounces per square yard, and T is pile thickness in inches. Pile thickness shall be determined in accordance with ASTM D 418.

(j) Dye Method:

Yarn (or skein) dyed - yarn dyed before being fabricated into carpet.

(k) Backing Materials: Primary backing materials shall be those customarily used and accepted by the trade for each type of carpet; polypropylene. Secondary backing to suit project requirements shall be those customarily used and accepted by the trade for each type of carpet, except when a special unitary back designed for gluedown is provided.

(l) Width: 3.6 m minimum usable carpet.

(m) Pattern, texture, and color: As indicated.

2.2.1.3 Carpet, Type C (Patterned Loop)

(a) Fabrication: Tufted.

(b) Category: Carpet Tile.

(c) Pile Type: Pattern loop.

(d) Pile Fiber: Branded commercial Antron Nylon, continuous filament.

(e) Pile Thickness: 0.351 cm.

(f) Gauge: 4.7 rows / cm.

(g) Yarn Weight: 813.8 gm/m2.

(h) Pile Density: 6261, as determined by using the formula below:

Density = (26 (36) / T (W)(36)/T

W is the pile yarn weight in ounces per square yard and T is the pile thickness in inches.

(i) Dye Method: 49% solution dyed / 51% yarn dyed.

(j) Backing Materials: Fiberglass reinforced vinyl composite. Backing minimum weight: 4000 g/m2.

(k) Size: 450 x 450 mm.

(l) Pattern, Texture, and Color: As indicated on color schedule drawings.

2.2.1.4 Carpet, Type D (Level Loop)

(a) Fabrication: Tufted.

(b) Category: Carpet Tile

(c) Pile Type: Patterned Level Loop.

(d) Pile Fiber: Branded commercial Antron nylon continuous filament.

(e) Thickness: 2.6 mm.

(f) Gauge: 2.54 mm.

(g) Yarn Weight: 882 g/m2.

(h) Pile Density: 9267, as determined by using the formula below:

Density = (W) (36) /T

W is the pile yarn weight in ounces and T is the pile thickness in inches.

(i) Dye Method: 80 % solution dyed/ 20 % yarn dyed .

(j) Backing Materials: Primary backing materials shall be polypropylene. Secondary backing to suit project requirements shall be those customarily used and accepted by the trade, except when a special unitary back designed for gluedown is provided.

(k) Size: 450 mm x 450 mm.

(l) Pattern, Texture, and Color: As indicated on color schedule drawings.

2.2.1.5 Carpet, Type E (Level Loop)

(a) Fabrication: Tufted.

(b) Category: Broadloom.

(c) Pile Type: Multi-level loop.

(d) Pile Fiber: 100% Antron Nylon, continuos filament.

(e) Pile Height: 6.35 mm - 3.18 mm.

(f) Gauge: 3.17 mm.

(g) Yarn Weight: 32 oz/sq. yd.

(h) Pile Density: 6227, as determined by using the formula below:

Density = (W) (36) /T

W is the pile yarn weight in ounces per square yard and T is the pile thickness in inches.

(i) Dye Method: Skein Dyed.

(j) Backing Materials: Primary backing materials shall be woven polypropylene. Secondary backing woven polypropylene.

(k) Width: 3.6 m minimum usable carpet.

(l) Pattern, Texture, and Color: As indicated on color schedule drawings.

2.2.1.6. Carpet, Type F

Carpet shall comply with the following:

(a) Fabrication: Tufted.

(b) Category: Broadloom.

(c) Pile Type: Cut Pile.

(d) Pile Fiber: 6.6 continuous filament nylon.

(e) Pile Height: 7.14 mm.

(f) Gauge: 2.54 mm.

(g) Yarn Weight, 38 oz/sq. yd.

(i) Pile Density: 6673.

Density = (W) (36) / T

W is pile yarn weight in ounces per square yard, and T is pile thickness in inches. Pile thickness shall be determined in accordance with ASTM D 418.

(j) Dye Method: Piece Dyed

(k) Backing Materials: Primary backing materials shall be polypropylene. Secondary backing woven polypropylene.

(l) Width: 3.6 m minimum usable carpet.

(m) Pattern, texture, and color: As indicated on color schedule drawings.

2.2.1.7 Carpet, Type G

(a) Fabrication: Tufted.

(b) Category: Carpet Tile.

(c) Pile Type: level loop.

(d) Pile Fiber: 100 % Nylon.

(e) Pile Thickness: 0.3 mm.

(f) Gauge: 2.54 mm.

(g) Weight Density: 121,008.

(h) Pile Density: 6051, as determined by using the formula below:

Density = (W)(36)/T

W is the pile yarn weight in ounces per square yard and T is the pile thickness in inches.

(i) Dye Method: 100% solution dyed.

(j) Backing Materials: Fiber reinforced vinyl composite. Backing minimum weight: 4000 g/m2.

(k) Size: 450 x 450 mm.

(l) Pattern, Texture, and Color: As indicated on color schedule drawings.

2.2.1.8 Carpet, Type H

(a) Fabrication: Tufted.

(b) Category: Carpet Tile

(c) Pile Type: Level Loop.

(d) Pile Fiber: 100 % nylon.

(e) Thickness: 2.6 mm.

(f) Gauge: 1.98 mm.

(g) Weight Density: 139,806.

(h) Pile Density: 6990, as determined by using the formula below:

Density = (W) (36) /T

W is the pile yarn weight in ounces and T is the pile thickness in inches.

(i) Dye Method: 100 % solution dyed.

(j) Backing Materials: Fiber reinforced with vinyl composite. Backing minimum weight: 4000 g/m2.

(k) Size: 450 mm x 450 mm.

(l) Pattern, Texture, and Color: As indicated on color schedule drawings.

2.2.1.9 Carpet, Type I

(a) Fabrication: Tufted.

(b) Category: Broadloom

(c) Pile Type: Patterned Level Loop.

(d) Pile Fiber: 100 % nylon.

(e) Pile Height: 3.6 mm.

(f) Gauge: 2.54 mm.

(g) Yarn Density: 26 oz. / sq. yd.

(h) Pile Density: 6545, as determined by using the formula below:

Density = (W) (36) /T

W is the pile yarn weight in ounces and T is the pile thickness in inches.

(i) Dye Method: Solution dyed.

(j) Backing Materials: Primary backing materials shall be woven polypropylene. Secondary backing of woven polypropylene.

(k) Width: 3.6 m.

(l) Pattern, Texture, and Color: As indicated on color schedule drawings.

2.2.1.10 Carpet, Type J

(a) Fabrication: Tufted.

(b) Category: Broadloom

(c) Pile Type: Heather Level Loop.

(d) Pile Fiber: 100 % nylon.

(e) Pile Height: 3.6 mm.

(f) Gauge: 2.54 mm.

(g) Yarn Weight: 26 oz. / sq. yd.

(h) Pile Density: 6545, as determined by using the formula below:

Density = (W) (36) /T

W is the pile yarn weight in ounces and T is the pile thickness in inches.

(i) Dye Method: Solution dyed.

(j) Backing Materials: Primary backing materials shall be woven polypropylene. Secondary backing of woven polypropylene.

(k) Width: 3.6 m.

(l) Pattern, Texture, and Color: As indicated on color schedule drawings.

2.2.2 Antimicrobial

All carpet tile shall have the following antimicrobial characteristics:

a. Broad Spectrum (inhibits fungi, gram-positive and gram-negative bacteria).

b. EPA Registration.

c. EPA Technical Data sheet for carpet.

d. Contains no arsenic and no heavy metals: no tin, no lead, no mercury, no copper, no zinc.

e. Non-halogenated: no fluorine, no chlorine, no bromine, no iodine.

f. Non-phenolic.

g. Contains no formaldehyde.

h. Low water soluble of 30 ppm.

i. Vapor pressure of 12 mm Hg at 27 degrees C (Celsius).

j. An oral LD50 toxicity rate of 2.3 grams/kg.

k. Independent test lab data available to verify evidence of bioefficacy.

2.2.3 Surface Texture

2.2.3.1 Loop Pile

Provide either single-level uncut pile or textured uncut pile creating an overall nondirectional surface.

2.2.4 Pile Yarn

Do not use undrawn fiber in spun yarn. Provide spun yarn of at least two ply for loop pile carpet tile. Use yarn setting method sufficient to assure permanent texture retention under normal use conditions and cleaning. Use autoclave or continuous heat process to set yarn in cut pile construction; yarns for fusion bonded plush cut pile may be crimp-set. Fiber denier and staple lengths may be subject to normal manufacturing tolerances with the following limitations:

a. Acceptable denier variance, plus or minus 1 percent, in individual filament denier and plus or minus 3 percent in average denier.

2.2.4.1 Blends

Do not add more than 3 percent metallic filaments or other materials to blends to reduce static propensity.

2.2.4.2 Twist and Twist Multiplier

For loop pile carpet tile, ASTM D 1423. The minimum twist multiplier for singles is 2.75; minimum twist for a 2-ply yarn is 80 percent of the twist in the singles yarns; for a 3-ply yarn, 70 percent; and for a 4-ply yarn, 60 percent.

2.2.4.3 Fiber Type

No private labeled fiber or yarn allowed. All carpet tile shall be type 6,6 or type 6 nylon only, as indicated.

2.2.4.4 Continuous Filament Nylon

Advanced generation, continuous high bulk or textured carpet fiber with average filament size of 15 denier or coarser modified to provide increased translucence or opacity for soil hiding.

2.2.4.5 Extractable Matter in Finished Yarn

ASTM D 2257. Not more than two percent, extracted using a single solvent, nylon-cyclohexane.

2.2.5 Primary Carpet Backing

Those customarily used and accepted by the trade for each type of carpet tile. Use a back coating compound of synthetic resin or natural or synthetic latex compound. Use back coating quantity normally used in the supplier's product.

2.2.6 Secondary Backing

Shall be fiberglass reinforced vinyl composite hardback for carpet tile.

2.2.6.1 Vinyl Hardback

A suitably compounded virgin polymer or copolymer of vinyl chloride resin. Virgin polymer is defined as a polymer or copolymer that has not been processed into a finished product prior to use in the hardback. Urethane backing materials are not acceptable. Use compound that is uniform and free from objectionable odor, and conforming to the following:

a. Hardback: Average not less than 2.92 mm in total backing thickness.

b. Weight: Average not less than 3.54 kg per sq. m.

c. Compression resistance: Not less than 0.689 MPa.
d. Adherence: No separation of the carpet tile and hardback.

e. Accelerated weathering: No cracking, stiffness, brittleness, soft or tacky and appreciable change in color, when compared to the unexposed sample, after 100 hours in the weatherometer.

f. Flexibility at 21 degrees C and -1 degrees C: No cracking, flaking, crazing, or show any other indication of failure.

g. Moisture absorbency: Maximum one percent moisture absorbency, after 4 hours submersion in water at 22 degrees C.

h. Volatile matter: No more than one percent.

2.3 PERFORMANCE REQUIREMENTS

a. Static Control: Static control shall be provided to permanently control static build-up to less than 3000 volts when tested at 20 percent relative humidity and 21 degrees C in accordance with AATCC 134 for carpet "field" pattern. Carpet tiles to incorporate a permanent static control system to control static build-up to less than 3.5 kv in accordance with AATCC 134. Carpet tiles shall have a lifetime anti-static warranty.

b. Flammability and Critical Radiant Flux Requirements: All carpet shall comply with 16 CFR 1630. Carpet in corridors and exits shall have a minimum average critical radiant flux of 0.45 (Class 1) watts per square centimeter when tested in accordance with ASTM E 648. All carpet tile shall have a minimum average critical radiant flux of 0.25 watts per sq. cm. Test carpet tile and hardback together, as they will be installed.

c. Tuft Bind: Tuft bind shall be a minimum 40 N average force for loop pile, minimum tuft bond for carpet tile in average force for loop pile is 67 N when tested in accordance with ASTM D 1335.

d. Ply: 3 ply with multi-level loop and 4 ply with level loop.

e. Colorfastness to Crocking: Dry and wet crocking shall comply with AATCC 165 and shall have a minimum rating of step 4 on the AATCC Color Transference Chart for all colors.

f. Colorfastness to Light: Colorfastness to light shall comply with AATCC 16 and shall have a minimum 4 grey scale rating after 40 hours.

g. Delamination Strength: Delamination strength for tufted carpet with a secondary back shall be minimum of 440 N/m in accordance with ASTM D 3936.

h. Shrinkage for Carpet Tile: The maximum immersion shrinkage in warp and filling directions is 0.381 mm for vinyl hardback carpet tile. The maximum air temperature shrinkage in warp and filling directions shall be 0.381 mm for vinyl hardback carpet tile. Test in accordance with paragraphs entitled "Shrinkage, Immersion"

and "Shrinkage, Air Temperature."

2.4 ADHESIVES AND CONCRETE PRIMER

Adhesives and concrete primers for installation of carpet shall be waterproof, nonflammable, meet local air-quality standards, and shall be as recommended by the carpet manufacturer. Seam adhesive shall be waterproof, nonflammable, and nonstaining as recommended by the carpet manufacturer. Release adhesive for modular tile carpet shall be as recommended by the carpet manufacturer.

2.5 MOLDING

Molding shall be vinyl. Vinyl molding shall be heavy-duty and designed for the type of carpet being installed. Floor flange shall be a minimum 50 mm wide. Color shall coordinate/blend with adjacent floor finishes.

2.6 TAPE

Tape for seams shall be as recommended by the carpet manufacturer for the type of seam used in installation.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Carpet shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Holes, cracks, depressions, or rough areas shall be repaired using material recommended by the carpet or adhesive manufacturer. Floor shall be free of any foreign materials and swept broom clean. Before beginning work, subfloor shall be tested with glue and carpet to determine "open time" and bond.

3.2 MOISTURE AND ALKALINITY TEST

Concrete slab shall be tested for moisture content and excessive alkalinity in accordance with CRI 104. The moisture content shall not exceed a hygrometer reading of 65 percent.

3.3 PREPARATION OF CONCRETE SUBFLOOR

Installation of the carpeting shall not commence until concrete substrate is at least 90 days old. The concrete surfaces shall be prepared in accordance with instructions of the carpet manufacturer. Type of concrete sealer, when required, shall be compatible with the carpet.

3.4 INSTALLATION

Installation shall be in accordance with the manufacturer's instructions and CRI 104. Edges of carpet meeting hard surface flooring shall be protected with molding, unless noted otherwise. Installation shall be in accordance with the molding manufacturer's instructions.

3.4.1 Installation of Broadloom

Broadloom carpet shall be installed direct glue down and shall be smooth, uniform, and secure, with a minimum

of seams. Seams shall be uniform, unnoticeable, and treated with a seam adhesive. Side seams shall be run toward the light where practical and where such layout does not increase the number of seams. Breadths shall be installed parallel, with carpet pile in the same direction. Patterns shall be accurately matched. Cutouts, as at door jambs, columns and ducts shall be neatly cut and fitted securely. Seams at doorways shall be located parallel to and centered directly under doors. Seams shall not be made perpendicular to doors or at pivot points. Seams at changes in directions of corridors shall follow the wall line parallel to the carpet direction. Corridors with widths

less than 1.8 m shall have the carpet laid lengthwise down the corridors.

3.4.2 Modular Tile Installation

Modular tiles shall be installed with release adhesive and shall be snugly jointed together. Tiles shall be laid in the same direction with accessibility to the subfloor where required. Installation shall be by the direct glue-down method using a full-spread of adhesive throughout the installation.

3.4.3 Substrate Preparation

Inspect rooms and areas to be carpeted. Before installation, verify that concrete floors comply with requirements on moisture content recommended by adhesive or carpet manufacturer's instructions. Carpet tiles shall not be installed on unsuitable surfaces which will prevent a proper installation. Notify Contracting Officer of any improper conditions before proceeding. Repair holes, cracks, depressions, or rough areas using material recommended by the carpet tile manufacturer. Grind raised areas or ridges smooth. Provide floor free of any foreign materials and swept broom clean. Comply with requirements for conditioning adhesives and minimum floor temperature before, during, and after installation as recommended by the carpet and adhesive manufacturer's instructions. However, in no case may floor temperature be less than 15.6 degrees C for 24 hours prior to, during, and after installation. Do not permit traffic or movement of furniture or equipment in carpeted areas for at least 24 hours after installation. Carpet installation constitutes validation by the Contractor that the substrate and conditions in the area meet all requirements for satisfactory installation.

3.5 CLEANING AND PROTECTION

3.5.1 Cleaning

After installation of the carpet, debris, scraps, and other foreign matter shall be removed. Soiled spots and adhesive shall be removed from the face of the carpet with appropriate spot remover. Protruding face yarn shall be clipped with sharp scissors and removed. Carpet shall be vacuumed clean with a two motor beater action vacuum.

3.5.2 Protection

The installed carpet shall be protected from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, hardboard sheets, or polyethylene film of an approved quality and thickness. Edges of kraft paper or polyethylene film protection shall be lapped and secured to provide a continuous cover. Traffic shall be restricted for at least 45 hours. Keep covering in repair and replace damaged portions. Protective covering shall be removed when directed by the Contracting Officer.

3.6 REMNANTS

Remnants remaining from the installation, consisting of scrap pieces more than 600 mm in dimension with more

than 0.6 square meters total, shall be provided to the Contracting Officer, labeled with project building and room numbers where used. Non-retained scraps shall be removed from site.

3.7 EXTRA CARPET TILES

Provide a minimum one box of each pattern and color of carpet tiles used per each building to the Contracting Officer, labeled with project building and room numbers where used.

--END OF SECTION--

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SAFETY PAYS

SECTION 09697

WALK-OFF MAT

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SAFETY PAYS

SECTION 09697

WALK-OFF MAT

PART 1 GENERAL

1.1 REFERENCES (Not Applicable)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

SD-04 Drawings

Walk-Off Mat; GA.

Submit detail drawings for approval, clearly indicating location of seams and method of installation. Manufacturer's literature shall be accepted as submittal to indicate installation materials to be used.

SD-14 Samples

Walk-Off Mat; GA.

Submit one sample of mat carpet tread in aluminum tread rails as indicated on drawings and of sufficient size to clearly show construction.

PART 2 PRODUCTS

2.1 CARPET TREADS

Furnish and install in size and quantity indicated on drawings Construction Specialties Inc., Pedimat Model PM375RM; Pawling Corp., EM-800 with Coral Plus insert CPLW model MRF-1002; or Balco Inc., Floormat System model MMC-R mounted walk-off mat. Provide walk-off mat in sections, as recommended by the manufacturer, to allow easy removal for cleaning trapped dirt from recess under mat. Seams shall run parallel to doors where possible. Walk-off mat shall have carpet treads of 100% Antron III nylon fiber unitary fusion bonded. Color shall be selected from manufacturers standard products, as indicated on drawings. Tread shall be securely locked into tread rails, yet remain easily accessible for in-field replacement.

2.2 MAT RAILS

Mat shall include aluminum tread rails fabricated of 6063-T52 aluminum alloy, and shall be continuously hinged at each tread connection to permit cleaning (independent vinyl hinges between tread rails shall not be acceptable). Tread rail finish shall be standard medium bronze Duranodic.

2.3 FRAME

Aluminum frame shall be standard medium bronze Duranodic finish. Vinyl fillers, as required, shall be furnished in standard medium bronze color. Fabricate frame in sections for easy removal from recess for cleaning. Sections shall be of number and size as recommended by manufacturer for ease of handling.

PART 3 EXECUTION

3.1 WORK ENVIRONMENT

All painting and finish work shall be complete. Ceilings and overhead work shall be tested, approved, and completed prior to installation of walk-off mat. Maintain room temperature at minimum 16 degrees C and relative humidity at the approximate level that will be maintained in the completed building for 24 hours prior to installation of recessed mat.

3.2 PREPARATION OF SURFACES

Clean floors of dust, dirt, solvents, oil, grease, paint, plaster, and other substances detrimental to proper performance of installation. Allow floors to thoroughly dry. Ensure floors are level, with maximum surface variation of 3.2 mm in 30 mm, noncumulative. Ensure concrete floors are free from scaling and irregularities and exhibit neutrality relative to acidity and alkalinity. Use an approved cementitious filler to patch cracks and small holes and for leveling.

3.3 INSTALLATION

Install aluminum frame in size and type indicated on drawings. Install walk-off mat in size, type, and locations as indicated on drawings. Install mat using manufacturer's standard installation method and instructions.

--END OF SECTION--

SUBMITTAL REGISTER
(ER415-1-10)

CONTRACT NO.

TITLE AND LOCATION

CONTRACTOR

SPEC. SECTION
ECTION

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. SD-04 Drawings										
		1	Recessed Walk-Off Mat; GA.										
			SD-14 Samples										
		2	Recessed Walk-Off Mat; GA.										
			2										

SAFETY PAYS

SECTION 09835

TEXTURED WALL COATINGS

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SAFETY PAYS

SECTION 09835

TEXTURED WALL COATINGS
(Applies to Brigade Headquarters, Battalion Headquarters and
Company Operations Buildings only)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84	1994 Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Textured Coatings; GA.

Letter from manufacturer stating that applicator has received manufacturer's training program. List of previous installations of comparable type and size.

SD-14 Samples

Textured Coatings; GA.

Three color samples of each type coating and color on 4 inch by
4 inch pieces of hardboard.

1.3 QUALITY ASSURANCE

1.3.1 Applicator shall have completed training by the manufacturer in the application of the specified materials.

1.3.2 Provide primers and other undercoat materials which are produced or are specifically recommended by the same manufacturer as the finish materials to ensure compatibility of the system. Use thinners approved by the coating manufacturer, and use only within recommended limits.

1.3.3 With each batch of material, the manufacturer shall supply a spray-out "Control Sample" representative of

the approved sample. The purpose of this control sample is to aid the applicator in producing the approved color, "Pattern Break" (visual texture), and tactile texture.

1.3.4 A mock-up for each coating shall be prepared by the applicator for approval by the Contracting Officer. Once this area has been approved, it shall remain intact and not painted over until all other surfaces requiring the system are completed. The approved mock-up shall establish a level of quality for the remainder of work in this section. Contractor shall be responsible for matching the mock-up for color, visual texture (Pattern Break) and tactile texture.

1.3.5 Finish shall be free from all runs, sags, voids, and excessive tactile texture.

1.4 DELIVERY AND STORAGE

1.4.1 All materials shall be delivered to the jobsite in unopened original containers bearing the manufacturer's label.

1.4.2 Store all materials in tightly covered containers in an area designated by the Contracting Officer. Maintain containers in a clean condition, free from foreign materials and residue. Protect from freezing and maintain temperatures below
38 degrees C.

1.4.3 Provide an adequate size type ABC fire extinguisher within the paint storage room. Under no circumstance shall paint or thinners be left any period of time in unopened containers. All rags wet with oil or thinner shall be removed from the building every night. Temperature of storage area shall be maintained between 10 degrees C, and 35 degrees C at all times.

1.5 JOB CONDITIONS

1.5.1 Do not apply primer or finish coat under the following conditions:

1.5.1.1 Temperature of substrate or air is below 18 degrees C or above 35 degrees C.

1.5.1.2 Relative humidity is 85 percent or higher.

1.5.1.3 Surface to be primed or topcoated is not thoroughly dried out.

1.5.1.4 Temperature of substrate is below the dewpoint.

1.5.2 Provide adequate ventilation of spaces while applying primer and finish coats.

1.5.3 All application of coatings shall be done under adequate illumination.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Provide all materials necessary to complete the system as recommended by the manufacturer including, but not limited to, primer and finish coat.

2.1.2 Textured Coating

a. The textured coating shall be an acrylic spray-on coating having a minimum thickness of 25 mils and made for finishing wall/ceiling surfaces.

b. Finished and fully cured (28 days) materials shall have the following characteristics:

Barcol Hardness Index	35.0 or greater
Flame Spread (ASTM E 84)	8.5 or less
Smoke Contribution (ASTM E 84)	7.0 or less
Federal Aviation Agency	
Vertical Burn Test #FAR 25.853(b)	0.1 seconds or less
Scrubability:	200 strokes of stiff .0254mm erosion or less brush with soap and water
Solvent Resistant:	(1 hour soak)
Water, Detergent, Ethanol, Naphtha	
Ethylene Glycol, Mineral Spirits	No change
Ammonium Hydroxide, Household Bleach	Slight softening
Paint Remover	Surface softening
Stain Resistant	(10 hour soak and wash with cleaner and water):
Water, Blood, Urine, Coffee, Tea, Blueberry, Mustard	No stain visible
Mildew Resistance:	No visible mildew after incubation for 30 days in 35 deg C and 90 percent RH under high contamination conditions
Color Pigments:	Pure, non-fading metal oxides containing not more than 0.06 percent lead based on total dry finish weight

2.2 EQUIPMENT

The system shall be applied by equipment recommended by the manufacturer but not limited to equipment supplied by the manufacturer. Generally, only conventional air-spraying equipment with an internal mix spray gun and an ASME rated dual-regulated pressure pot can be used. The compressor shall be of adequate size to provide the necessary volume of air to the spray gun on a continuous basis.

2.3 MIXES

The system shall be delivered to the jobsite ready for use with no field tinting or thinning.

PART 3 EXECUTION

3.1 ACCEPTANCE OF SURFACES

Inspect all new and existing surfaces to receive finishes to assure that they are in proper condition for the work to

be performed under this section. Clean surfaces to be coated before applying any materials. Remove oils and grease prior to mechanical cleaning. Program cleaning and coating so that contaminantes from cleaning process will not fall into wet or newly coated surrfaces.

3.1.1 If the surfaces are not thoroughly dry or if they cannot be put in proper condition to be primed or finished by customary cleaning methods, sanding, or spackling, notify the Contracting Officer in writing.

3.1.2 Priming or finishing any surface will constitute acceptance of the surface by the applicator.

3.2 PROTECTION

3.2.1 Furnish all dropcloths and mask all rooms and areas where the system is being applied to adequately protect flooring, trim, ceiling, and other work from overspray.

3.2.2 Remove or otherwise protect plated hardware, accessories, device plates, lighting plates, factory-finished work, and similar items. Upon completion of each space, carefully reset all items. Use only skilled mechanics for removal, resetting and protection.

3.3 SURFACE PREPARATION

3.3.1 Gypsum Wallboard

All cracks, scratches, dents, abrasions, and other surface flaws shall be filled with joint compound or spackle and sanded smooth and flush with surrounding surfaces.

3.3.2 Cementitious Substrates

Prepare cementitious surfaces such as concrete, concrete block, cement plaster, etc. by cleaning as noted above; then patch all major joint holes, honeycombs, etc. using structural grout as specified in the applicible Specification section. Then grind, fill, and float smooth all form seams and other minor inperfections using SKIMM as manufactured by TRIARCH Industries of Houston Texas. (1 800 537-6111) or approved equal. Allow SKIMM to dry 24 hours. If substrate is concrete, dampen surfaces just prior to installation of materials but wipe any active condensation or water sufficient to cause a wet glaze. If surface to be coated is non-coated then use block filler in lieu of the SKIMM material.

3.4 APPLICATION

3.4.1 Prepare and apply the system in strict accordance with manufacturer's written instructions.

3.4.2 Primers shall be applied in as many coats as necessary to the substrate to produce a uniform appearance.

3.4.3 Sand primer over gypsum board with 120 grit sandpaper prior to application of the system.

3.4.4 All materials shall be applied under adequate illumination.

3.4.5 Primers shall be completely dry prior to the application of the system.

3.4.6 All closets and storage areas shall be finished inside the same as adjoining rooms unless otherwise indicated.

3.4.7 Make edges of the system adjoining other materials or other colors sharp and clean without overlapping.

3.5 COMPLETION

3.5.1 Cleaning

At the completion of the work, remove all paint, overspray, oil, grease, or other stains caused by this work, from floors, walks, glass, fixtures, hardware, equipment, and other surfaces. Remove all equipment, materials, and debris caused by work of this section and leave the site of the work in clean condition.

3.5.2 Touch-Up

Touch-Up and repair any work applied under the contract which, for any reason has been damaged during construction work.

-- End of Section --

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 09835
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. SD-08 Statements										
		1	Textured Coatings; GA.										
			SD-14 Samples										
		2	Textured Coatings; GA.										

SAFETY PAYS

SECTION 09900

PAINTING, GENERAL
07/92

PART 1 GENERAL 09900-1
1.1 REFERENCES 09900-1
1.2 SUBMITTALS 09900-3
1.3 PACKAGING, LABELING, AND STORING 09900-5
1.4 APPROVAL OF MATERIALS 09900-5
1.5 ENVIRONMENTAL CONDITIONS 09900-5
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PART 2 PRODUCTS 09900-6
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SAFETY PAYS

SECTION 09900

PAINTING, GENERAL
07/92

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH-02	(1996) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 150	(1996) Portland Cement
ASTM D 3273	(1994) Resistance to Growth of Mold on the Surface of Interior Coating in an Environmental Chamber
ASTM D 3274	(1995) Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation
ASTM D 4214	(1989) Evaluating the degree of Chalking of Exterior Paint Films

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1500	(Rev A) Sealer, Surface (Latex Block Filler)
CID A-A-2246	(Rev A) Paint, Latex (Gloss, Interior)
CID A-A-2247	(Basic) Paint, Latex (Semigloss, Interior)
CID A-A-2248	(Basic) Paint, Latex, (Flat, Interior)
CID A-A-2336	(Rev A) Primer Coating (Alkyd, Exterior Wood, White and Tints)
CID A-A-2867	(Basic) Coating, Polyurethane, Single Component Moisture Cure, Alipathic
CID A-A-2962	(Basic) Enamel, Alkyd)
CID A-A-2994	(Basic) Primer Coating, Interior, for Walls and Wood

FEDERAL SPECIFICATIONS (FS)

FS TT-C-535	(Rev B; Am 2) Coating, Epoxy, Two Component, for Interior Use on Metal, Wood, Wallboard, Painted Surfaces Concrete and Masonry
FS TT-C-542	(Rev E) Coating, Polyurethane, Oil-Free, Moisture Curing
FS TT-C-555	(Rev B; Am 1) Coating, Textured (for Interior and Exterior Masonry Surfaces)
FS TT-E-489	(Rev J) Enamel, Alkyd, Gloss, Low Voc Content
FS TT-E-505	(Rev B) Enamel (Odorless, Alkyd, Interior, High Gloss)
FS TT-E-506	(Rev K; Am 1) Enamel, Alkyd, Gloss, Tints and White (for Interior Use)
FS TT-E-508	(Rev C; Am 1) Enamel, Interior Semigloss, Tints and White
FS TT-E-509	(Rev C) Enamel, Odorless, Alkyd, Interior, Semigloss, White and Tints
FS TT-E-545	(Rev C) Primer (Enamel-Undercoat, Alkyd, Odorless, Interior, Flat, Tints and White)
FS TT-E-2784	(Rev A) Enamel, (Acrylic-Emulsion, Exterior Gloss snd Semigloss)
FS TT-F-1098	(Rev D) Filler, Block, Solvent-Thinned, for Porous Surfaces (Concrete Block, Cinder Block, Stucco, Etc.)
FS TT-P-19	(Rev D; Am 1) Paint, Latex (Acrylic Emulsion, Exterior Wood and Masonry)
FS TT-P-29	(Rev K) Paint, Latex
FS TT-P-30	(Rev E; Am 1) Paint, Alkyd, Odorless, Interior, Flat, White and Tints
FS TT-P-37	(Rev D; Am 4 Reinstatement Notice) Paint, Alkyd Resin: Exterior Trim, Deep Colors
FS TT-P-38	(Rev E) Paint, Aluminum (Ready-Mixed)
FS TT-P-91	(Rev D; Am 2) Paint, Rubber-Base, for Interior Use (Concrete and Masonry Floors)
FS TT-P-95	(Rev C; Am 1) Paint, Rubber: for Swimming Pools and Other Concrete and Masonry Surfaces
FS TT-P-102	(Rev F) Paint, Oil, (Alkyd Modified, Exterior, Low VOC)
FS TT-P-645	(Rev B) Primer, Paint, Zinc-Molybdate, Alkyd Type

FS TT-P-650	(Rev D) Primer Coating, Latex Base, Interior, White (for Gypsum Wallboard, or Plaster)
FS TT-P-1511	(Rev B) Paint, Latex (Gloss and Semigloss, Tints and White) (for Interior Use)
FS TT-S-708	(Rev A; AM 2) Stain; Oil; Semi-Transparent, Wood, Exterior
FS TT-S-001992	(Basic) Stain; Latex, Exterior for Wood Surfaces
FS TT-S-711	(Rev C) Stain; Oil Type, Wood, Interior
FS TT-V-51	(Rev F) Varnish: Asphalt
FS TT-V-85	(Rev C; Int Am 2) Varnish, Oil, Low Sheen, Brush or Spray Application
FS TT-V-86	(Rev C; Am 1) Varnish, Oil, Rubbing (for Metal and Wood Furniture)

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 5	(1995) Zinc Dust, Zinc Oxide and Phenolic Varnish Paint
SSPC Paint 18	(1991) Chorinated Rubber Intermediate Coat Paint
SSPC Paint 20	(1991) Zinc Primers (Type I - Inorganic and Type - Organic)
SSPC Paint 21	(1991) White or Colored Silicone Alkyd Paint
SSPC Paint 23	(1982) Latex Primer for Steel Surfaces
SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)
SSPC SP 1	(1982) Solvent Cleaning
SSPC SP 2	(1995) Hand Tool Cleaning
SSPC SP 3	(1995) Power Tool Cleaning
SSPC SP 7	(1994) Brush-Off Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Paint; FIO.

The names, quantity represented, and intended use for the proprietary brands of materials proposed to be substituted for the specified materials when the required quantity of a particular batch is 200 L or less.

SD-06 Instructions

Mixing and Thinning; FIO.

Application; FIO.

Manufacturer's current printed product description, material safety data sheets (MSDS) and technical data sheets for each coating system. Detailed mixing, thinning and application instructions, minimum and maximum application temperature, and curing and drying times between coats for epoxy, moisture-curing polyurethane, and liquid glaze coatings. Detailed application instructions for textured coatings shall be provided.

SD-09 Reports

Paint; FIO.

A statement as to the quantity represented and the intended use, plus the following test report for batches in excess of 200 L:

a. A test report showing that the proposed batch to be used meets all specification requirements, or:

b. A test report showing that a previous batch of the same formulation as the batch to be used met all specification requirements, plus, on the proposed batch to be used, a report of test results for properties of weight per liter, viscosity, fineness of grind, drying time, color, and gloss.

SD-13 Certificates

Lead; FIO.

Mildewcide and Insecticide; FIO.

Volatile Organic Compound (VOC) Content; FIO.

Certificate stating that paints for interior use contain no mercurial mildewcide or insecticide. Certificate stating that paints proposed for use contain not more than 0.06 percent lead. Certificate stating that paints proposed for use meet the VOC regulations of the local Air Pollution Control Districts having jurisdiction over the geographical area in which the project is located.

SD-14 Samples

Moisture-curing Polyurethane; FIO.

A complete moisture-curing polyurethane system applied to a panel of the same material as that on which the coating will be applied in the work and for each color specified. The sample panels will be used for quality control in applying the system.

Paint; GA.

While the material is at the site or source of supply, and at a time agreeable to the Contractor and the Contracting Officer, a 1 liter sample of each color and batch, except for quantities of 200 liters or less, shall be taken by random selection from the sealed containers by the Contractor in the presence of a representative of the Contracting Officer. The contents of the containers to be sampled shall be thoroughly mixed to ensure that the sample is representative. Samples shall be identified by designated name, specification number, manufacturer name and address, batch number, project contract number, intended use, and quantity involved.

1.3 PACKAGING, LABELING, AND STORING

Paints shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 20 liters. Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 4 and 35 degrees C. Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

1.4 APPROVAL OF MATERIALS

When samples are tested, approval of materials will be based on tests of the samples; otherwise, materials will be approved based on test reports furnished with them. If materials are approved based on test reports furnished, samples will be retained by the Government for testing should the materials appear defective during or after application. In addition to any other remedies under the contract the cost of retesting defective materials will be at the Contractor's expense.

1.5 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 7 and 35 degrees C when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings. Water-thinned coatings shall be applied only when ambient temperature is between 10 and 32 degrees C. Epoxy, and moisture-curing polyurethane coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-curing polyurethane shall not be applied when the relative humidity is below 30 percent.

1.6 SAFETY AND HEALTH

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.6.1 Worker Exposures

Exposure of workers to chemical substances shall not exceed limits as established by ACGIH-02, or as required by a more stringent applicable regulation.

1.6.2 Toxic Compounds

Toxic compounds having ineffective physiological properties, such as odor or irritation levels, shall not be used unless approved by the Contracting Officer.

1.6.3 Training

Workers having access to an affected work area shall be informed of the contents of the applicable material data safety sheets (MSDS) and shall be informed of potential health and safety hazard and protective controls associated with materials used on the project. An affected work area is one which may receive mists and odors from the painting operations. Workers involved in preparation, painting and clean-up shall be trained in the safe handling and application, and the exposure limit, for each material which the worker will use in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment.

1.6.4 Coordination

Work shall be coordinated to minimize exposure of building occupants, other Contractor personnel, and visitors to mists and odors from preparation, painting and clean-up operations.

PART 2 PRODUCTS

2.1 PAINT

The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, cement-emulsion filler, and other coatings, whether used as prime, intermediate, or finish coat. Paint shall conform to the respective specifications listed for use in the painting schedules at the end of this section, except when the required amount of a material of a particular batch is 200 liters or less, an approved first-line proprietary paint material with similar intended usage and color to that specified may be used. Additional requirements are as follows:

2.1.1 Colors and Tints

Colors shall be as noted on the finish schedule. Tinting of epoxy, and urethane, paints shall be done by the manufacturer. Stains shall conform in shade to manufacturer's standard color. The color of the undercoats shall vary slightly from the color of the next coat.

2.1.2 Mildewcide and Insecticide

Paint specified for all coats applied to fabrics and vapor barrier jackets over insulation and other surfaces to receive a coating in showers and wet areas shall contain a mildewcide that will not adversely affect the color, texture, or durability of the coating. The mildewcide shall be incorporated into the paint by the manufacturer and shall attain a surface disfigurement rating of 8 or greater when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274. Mercurial mildewcide shall not be used in interior paint. Insecticides shall not be used in paint.

2.1.3 Lead

Paints containing lead in excess of 0.06 percent by weight of the total nonvolatile content (calculated as lead metal) shall not be used.

2.1.4 Chromium

Paints containing zinc chromate or strontium chromate pigments shall not be used.

2.1.5 Volatile Organic Compound (VOC) Content

Paints shall comply with applicable state and local laws enacted to insure compliance with Federal Clean Air Standards and shall conform to the restrictions of the local air pollution control authority.

2.1.6 Multi-color Seamless Wall Coating

Coating system shall meet the following requirements:

Test Method	Performance
ASTM D 1308	No staining from dirt, oils, food, chemicals, or mild acids
ASTM D 2247	No blistering or color change
ASTM D 2248	No deterioration, one hour
ASTM D 2486	1,000 cycles - film remains intact
ASTM D 2794	No break at 50 inch-pounds

2.2 WATER REPELLENT STAIN

Water repellent stain shall be as specified in Section 09960 WATER REPELLENT STAIN.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

3.2 SURFACE PREPARATION

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed with clean cloths and cleaning solvents prior to mechanical cleaning. Cleaning solvents shall be of low toxicity with a flashpoint in excess of 38 degrees C. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primmed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the

adjacent areas.

3.2.1 Concrete, Stucco and Masonry Surfaces

Concrete, stucco and masonry surfaces shall be allowed to dry at least 30 days before painting, except concrete slab on grade which shall be allowed to cure 90 days before painting. Surfaces shall be cleaned in accordance with ASTM D 4258. Glaze, efflorescence, laitance, dirt, grease, oil, asphalt, surface deposits of free iron and other foreign matter shall be removed prior to painting. Surfaces to receive polyurethane, chlorinated rubber or epoxy coatings shall be acid-etched or mechanically abraded as specified by the coating manufacturer, rinsed with water, allowed to dry, and treated with the manufacturer's recommended conditioner prior to application of the first coat.

3.2.2 Ferrous Surfaces

Ferrous surfaces including those that have been shop-coated, shall be solvent-cleaned. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with hand tools according to SSPC SP 2, power tools according to SSPC SP 3 or by sandblasting according to SSPC SP 7. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

3.2.3 Nonferrous Metallic Surfaces

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces shall be solvent-cleaned in accordance with SSPC SP 1.

3.2.4 Gypsum Board Surfaces

Gypsum board surfaces shall be dry and shall have all loose dirt and dust removed by brushing with a soft brush, rubbing with a cloth, or vacuum-cleaning prior to application of the first-coat material. A damp cloth or sponge may be used if paint will be water-based.

3.2.5 Mastic-Type Surfaces

Mastic-type surfaces shall be prepared by removing foreign material.

3.2.6 Plaster Surfaces

Plaster shall age at least 30 days before painting. Plaster shall be clean and free from loose matter and shall have an instrument-measured moisture content not exceeding 8 percent.

3.2.7 Wood Surfaces

Wood surfaces shall be cleaned of foreign matter. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints. Small, dry seasoned knots shall be scraped, cleaned, and given a thin coat of commercial knot sealer, before application of the priming coat. Pitch on large, open, unseasoned knots and all other beads or streaks of pitch shall be scraped off, or, if it is still soft, removed with mineral spirits or turpentine, and the resinous area shall be thinly coated with knot sealer. Finishing nails shall be set, and all holes and surface imperfections shall be primed. After priming, holes and imperfections in finish surfaces shall be filled with putty or plastic wood filler, colored to match the finish coat if natural finish is required, allowed to dry, and sanded smooth. Putty or wood filler shall be compatible with

subsequent coatings. Interior wood surfaces to receive stain shall be given a coat of wood filler not less than 8 hours before the application of stain; excess filler shall be removed and the surface sanded smooth. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter, unless otherwise authorized.

3.2.8 Previously Painted Surfaces

Previously painted surfaces damaged during construction shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter. Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed. Slick surfaces shall be roughened. Damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls shall be repaired with suitable material to match adjacent undamaged areas. Edges of chipped paint shall be feather edged and sanded smooth. Rusty metal surfaces shall be cleaned as per SSPC requirements. Solvent, mechanical, or chemical cleaning methods shall be used to provide surfaces suitable for painting. Chalk shall be removed so that when tested in accordance with ASTM D 4214, the chalk resistance rating is no less than 8. New, proposed coatings shall be compatible with existing coatings. If existing surfaces are glossy, the gloss shall be reduced.

3.3 MIXING AND THINNING

When thinning is approved as necessary to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 0.5 L of suitable thinner per liter. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed local limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.3.1 Cement-Emulsion Filler Coat

Cement and aggregate shall be dry-mixed so that uniform distribution and intermixing are obtained. Mixing liquid and one-half of the total amount of water shall be premixed and added gradually to the white portland cement and aggregate with constant stirring until a thick, smooth material is obtained. Emulsion paint shall then be added to the mixture and stirred until uniformity is obtained. The blend shall have a thick, creamy consistency. The remainder of the water shall be added if necessary to obtain a material with adequate application properties. Blending resin emulsion or emulsion paint with any other component shall be done with caution; too rapid an agitation will cause air entrapment and foaming.

3.3.2 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.4 APPLICATION

Painting practices shall comply with applicable state and local laws enacted to insure compliance with Federal Clean Air Standards. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film

shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

3.4.1 Ventilation

Affected areas shall be ventilated during paint application so that workers exposure to chemical substances shall not exceed limits as established by ACGIH-02, or as required by a more stringent applicable regulation. Interior work zones having a volume of 280 cubic meters or less shall be ventilated at a minimum of 2 air exchanges per hour. Ventilation in larger work zones shall be maintained by means of mechanical exhaust. Solvent vapors shall be exhausted outdoors, away from air intakes and workers. Return air inlets in the work zone shall be temporarily sealed before start of work until the coatings have dried.

3.4.2 Respirators

Operators and personnel in the vicinity of operating paint sprayers shall wear respirators.

3.4.3 First Coat

The first coat on plaster, gypsum wallboard, and other surfaces shall include repeated touching up of suction spots or overall application of primer or sealer to produce uniform color and gloss. Excess sealer shall be wiped off after each application. The first coat on both faces of wood doors shall be applied at essentially the same time. Glazed doors and sashes shall be given the specified coating system within 3 weeks of the time they are glazed, but not before the glazing material has set; paint shall overlay glass about 1.78 mm all around. Each varnish coat shall be sanded lightly prior to application of subsequent coats.

3.4.4 Timing

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of two-component systems shall be followed.

3.4.5 Stains

On smooth exterior wood surfaces such as the planed face of bevel siding, the stain shall be applied at a spreading rate of 9.8 to 12.3 square meters per liter. On rough surfaces such as an unplaned or scarred face of bevel siding, the stain shall be spread at the rate of 4.9 to 6.1 square meters per liter or as recommended by the manufacturer. Oil-type stain shall be applied by brushing with the grain for the full length of the board or course of siding.

3.4.6 Fillers

Concrete and masonry surface voids shall be filled; however, surface irregularities need not be completely filled. The dried filler shall be uniform and free of pinholes. Filler shall not be applied over caulking compound.

3.4.6.1 Cement-Emulsion Filler

Immediately before filler application, surfaces shall be dampened uniformly and thoroughly, with no free surface water visible, by several applications of potable water with a fog spray, allowing time between the sprayings for water to be absorbed. Cement-emulsion filler shall be scrubbed into the surface vigorously with a stiff-bristled brush having tampico or palmyra bristles not longer than 63 mm. At least 24 hours shall elapse before applying exterior emulsion paint over cement-emulsion filler. When the ambient temperature is over 29 degrees C, cement-emulsion filler surfaces shall be dampened lightly with a fog spray of potable water immediately prior to application of the subsequent paint coat.

3.4.6.2 Solvent-Thinned Filler

Solvent-thinned filler, FS TT-F-1098, shall be applied to dry surfaces only and may be applied by brush or roller. Filler shall be allowed to set for 3 to 5 minutes or until the filler becomes tacky, and the excess material shall then be removed with a rubber squeegee. Surface voids shall be filled; however, surface irregularities need not be completely filled.

3.4.6.3 Latex Filler

Latex filler, CID A-A-1500, shall be applied according to the manufacturer's instructions. Surface voids shall be filled and the filler allowed to dry the length of time specified by the manufacturer prior to applying successive coats of paint.

3.4.7 Textured Ceiling Coating

Application of textured coating, FS TT-C-555, shall be as specified in the manufacturer's printed directions at a rate of 1.1 to 1.3 square meters per liter in one coat.

3.4.8 Ferrous-Metal Primer

Primer for ferrous-metal shall be applied to ferrous surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

3.4.9 Multi-color Seamless Wall Coating

Manufacturer's instructions on surface preparation and coating application shall be followed to provide a heavy duty finish using a primer/sealer to seal the substrate followed by a finish coat. This finish coat is a two step spray applied process. The first step is to shear multi-color particles into a uniform background color. The second step is to apply the pattern coat.

3.5 PIPE COLOR CODE MARKING

SAFETY PAYS

Pipes in exposed areas and in accessible pipe spaces shall be provided with color band and titles adjacent to all valves, except those provided at plumbing fixtures, at not more than 12 meter spacing on straight pipe runs, adjacent to change in direction, and on both sides where pipes pass through walls or floors. Color code marking shall be of the color listed in TABLE I and the size listed in TABLE II. The arrows shall be installed adjacent to each band to indicate the direction of flow in the pipe. The legends shall be printed in upper-case black letters as listed in TABLE I. Letter sizes shall be as listed in TABLE II. Marking shall be painted or applied using colored, pressure-sensitive adhesive markers of standard manufacture. Paint shall be as specified for insulated and uninsulated piping.

TABLE I. COLOR CODES FOR MARKING PIPE

Material	Band	Letters and Arrow*	Legend
Cold water (potable)	Green	White	POTABLE WATER
Fire protection water	Red	White	FIRE PR. WATER
Hot water (domestic)	Green	White	H.W.
Hot water recirculating (domestic)	Green	White	H.W.R.
High temp. water supply	Yellow	Black	H.T.W.S.
High temp. water return	Yellow	Black	H.T.W.R.
Boiler feed water	Yellow	Black	B.F.
Low temp. water supply (heating)	Yellow	Black	L.T.W.S.
Low temp. water return (heating)	Yellow	Black	L.T.W.R.
Condenser water supply	Green	White	COND. W.S.
Condenser water return	Green	White	COND. W.R.
Chilled water supply	Green	White	C.H.W.S.
Chilled water return	Green	White	C.H.W.R.
Treated water	Yellow	Black	TR. WATER
Chemical feed	Yellow	Black	CH. FEED
Compressed air	Yellow	Black	COMP. AIR
Natural gas	Blue	White	NAT. GAS
Freon	Blue	White	FREON
Fuel oil	Yellow	Black	FUEL OIL
Steam	Yellow	Black	STM.
Condensate	Yellow	Black	COND.

TABLE II. COLOR CODE MARKING SIZES

Outside Diameter of Pipe Covering (mm)	Width of Color Band (mm)	Arrow Length x Width (mm)	Size of Legend Letters and Numerals (mm)
Less than 38	200	200 x 57	13
38 to 60	200	200 x 57	19
60 to 150	300	200 x 57	31
200 to 225	600	300 x 110	63
Over 250	800	300 x 115	88

3.6 MISCELLANEOUS PAINTING

3.6.1 Lettering

Lettering shall be provided as scheduled on the drawings, shall be Helvetica Medium type, 8 inch upper case letters and 6 inch lower case in height and shall be color as indicated on the signage schedule. Samples shall be approved before application.

3.7 SURFACES TO BE PAINTED

Surfaces listed in the room finish schedule or painting schedules at the end of this section, other than those listed in paragraph SURFACES NOT TO BE PAINTED, shall be painted as scheduled.

3.8 SURFACES NOT TO BE PAINTED

Surfaces in the following areas are not to be painted: Walls and ceilings in crawl spaces; unexposed interior ferrous surfaces; aluminum or sized vapor barrier jacketing over insulation pipes; in unexposed locations that do not require color coding, operating parts and labels, sprinkler heads and fire detection elements. In addition, surfaces of hardware, fittings, and other factory finished items shall not be painted.

3.9 CLEANING

Cloths, cotton waste and other debris that might constitute a fire hazard shall be placed in closed metal containers and removed at the end of each day. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner. Paint and other deposits on adjacent surfaces shall be removed and the entire job left clean and acceptable.

3.10 PAINTING SCHEDULES

The following painting schedules identify the surfaces to be painted and prescribe the paint to be used and the number of coats of paint to be applied. Contractor options are indicated by ------or------ between optional systems or coats.

EXTERIOR PAINTING SCHEDULE

Surface	First Coat	Second Coat	Third Coat
Concrete masonry units.	Cement-emulsion filler	FS TT-E-2784 Type III	None
	CID A- A-1500	FS TT-E-2784 Type III	None
	FS TT-E-2784 Type III	FS TT-E-2784 Type III	None

NOTE: Cement-emulsion filler coat shall be acrylic-based and shall consist of the following ingredients in the proportion stated: white portland cement, ASTM C 150, Type I, 7.5 kg; aggregate 15 kg; mixing liquid, factory-prepared acrylic containing 46 to 47 percent solids, 3 liters; potable water 4 liters maximum; exterior emulsion paint, FS TT-E-2784 Type III 4 liters. Aggregate shall consist of Washed silica sand of the following gradation:

U.S. Sieve Size	Percent Sand (by Weight) Passing Individual Sieve
0.850 mm (20)	100
0.600 mm (30)	95 - 100
0.300 mm (50)	30 - 65
0.150 mm (100)	0 - 10
0.075 mm (200)	0 - 1

Concrete, unless otherwise specified.	FS TT-E-2784 Type III	FS TT-E-2784 Type III	None
Concrete: walls	SSPC Paint 18 thin with 1part of approved thinner to 4 parts of paint by volume	SSPC Paint 18	SSPC Paint 18
Wood, unless otherwise specified.	CID A-A-2336	FS TT-E-2784	FS TT-E-2784
	FS TT-E-2784 Type III	FS TT-E-2784	FS TT-E-2784
Wood: stain finish.	FS TT-S-708	None	None
	FS TT-S-001992 Class B	FS TT-S-001992 Class B	None
Ferrous metal unless otherwise specified	SSPC Paint 5 Type I	CID A-A-2962 Type 1	CID A-A-2962
	SSPC Paint 25 Type I	CID A-A-2962 Type 1	CID A-A-2962

	SSPC Paint 23 Type I	FS TT-E-2784 Type I	FS TT-E-2784
Ferrous metal: subject to high temperature, up to 232 degrees C as follows:	SSPC Paint 20 Type I	None	None
Galvanized metal.	FS TT-E-2784 Type III	FS TT-E-2784	FS TT-E-2784
Aluminum aluminum-alloy, and other non-ferrous metal (non-galvanized)	CID A-A-2867 FS TT-E-2784 Type III	CID A-A-2867 FS TT-E-2784	None FS TT-E-2784

INTERIOR PAINTING SCHEDULE

Surface	First Coat	Second Coat	Third Coat
Plaster, gypsum board, concrete, and concrete masonry units not requiring a smooth finish, unless otherwise specified.	CID A-A-2994 Type II	CID A-A-2246 ----------or---------- CID A-A-2247 ----------or---------- CID A-A-2248	None None None
Concrete masonry units requiring a smooth finish	CID A-A-1500	CID A-A-2994 Type II	CID A-A-2246 -----or----- CID A-A-2247 -----or-----

			CID A-A-2248
Concrete: ceilings	Primer as recommended by FS TT-C-555 manufacturer	FS TT-C-555 Type I	None
Concrete masonry units in food-preparation, food-serving, restrooms and laundry areas, unless otherwise specified	CID A-A-1500	CID A-A-2994 Type II	FS TT-E-2784
Plaster and gypsum board: in food-preparation, food-serving, restrooms and laundry areas, unless otherwise specified.	CID A-A-2994 Type II	FS TT-E-2784	None
Concrete masonry units: in, shower areas, and areas requiring a high degree of sanitation, unless otherwise specified.	CID A-A-1500	CID A-A-2994 Type II	FS TT-E-2784
Plaster and gypsum board: in shower areas, and areas requiring a high degree of sanitation,	CID A-A-2994 Type II	FS TT-E-2784	None

unless otherwise specified.			
Ferrous Metal unless otherwise specified	SSPC Paint 25 Type I	CID A-A-2962 Type I	CID A-A-2962
	SSPC Paint 23	FS TT-E-2784	FS TT-E-2784
	CID A-A-2867	CID A-A-2867	None
Galvanized metal:	FS TT-E-2784 Type III	FS TT-E-2784	None
	SSPC Paint 25	CID A-A-2962	CID A-A-2962

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 09900
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Paint; FIO.										
			SD-06 Instructions										
		2	Mixing and Thinning; FIO.										
		3	Application; FIO.										
			SD-09 Reports										
		4	Paint; FIO.										
			SD-13 Certificates										
		5	Lead; FIO.										
		6	Mildewcide and Insecticide; FIO.										
		7	Volatile Organic Compound (VOC) Content; FIO.										
			SD-14 Samples										
		8	Moisture-curing Polyurethane; FIO.										
		9	Paint; GA.										

SAFETY PAYS

SECTION 09950

WALL COVERINGS
01/93

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1.2 SUBMITTALS 09950-1
1.3 DELIVERY AND STORAGE 09950-2
1.4 ENVIRONMENTAL REQUIREMENTS 09950-2
1.5 EXTRA MATERIALS 09950-2

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SAFETY PAYS

SECTION 09950

WALL COVERINGS
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 423	(1990a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 84	(1997) Surface Burning Characteristics of Building Materials

FEDERAL SPECIFICATIONS (FS)

FS CCC-W-408	(Rev D) Wall Covering, Vinyl-Coated
FS L-P-1040	(1977) Plastic Sheets and Strips (Polyvinyl Floride)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 265	(1994) Fire Tests For Evaluating Room Fire Growth

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Wall Covering and Accessories; FIO.

Manufacturer's descriptive data.

SD-06 Instructions

Installation; FIO.

Installation instructions for wall covering and accessories.

Maintenance; FIO.

Cleaning and maintenance instructions for wall covering and accessories.

SD-14 Samples

Wall Covering and Accessories; GA.

Three samples of each indicated type, pattern, and color of wall covering required. Samples of wall covering shall be minimum 125 mm by 175 mm and of sufficient size to show pattern repeat. Three samples of each indicated type edge guard and wainscot cap required.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers. Materials shall be stored in accordance with the manufacturer's instructions in a clean dry area with temperature maintained above 16 degrees C.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas to receive wall covering shall be maintained at a temperature above 16 degrees C for 3 days before, during, and 3 days after application.

1.5 EXTRA MATERIALS

305 mm of full-width wall covering for each 100 linear meters of wall covering installed shall be furnished. The wall covering shall be from the same lot as that installed.

PART 2 PRODUCTS

2.1 WALL COVERINGS

Wall coverings shall be manufacturer's standard material designed specifically for the specified use.

2.1.1 Vinyl Wall Covering Type II, Class A

Vinyl wall covering shall be a vinyl coated woven or nonwoven fabric with mildew and germicidal additives and shall conform to FS CCC-W-408, Type II, 0.445 to 0.815 kg total weight per square meter and width of 1340/1370 mm. Pattern and color of vinyl wall covering shall be as shown on drawings finish schedule.

A polyvinyl fluoride film 0.0127 mm thick shall be factory applied to the wall coverings to be installed in Building 7039, Barracks, only. The film shall conform to FS L-P-1040, Type I, Grade B, Class 2.

2.1.2 Fabric Wall Covering Type A

Fabric wall covering shall be a woven fabric with acrylic backing and shall be mildew resistant. Fabric wall covering shall have a Class A flame spread rating of 0-25 and smoke development rating of 0-50 when tested in accordance with ASTM E 84 and room fire growth in accordance with NFPA 265. Pattern and color of fabric wall covering shall be as selected from manufacturer's standard colorways and patterns, as shown on the drawings. Fabric wall covering shall meet or exceed the following:

a. Face fiber content: 100% Polyolefin.

b. Width: 1372 mm.

c. Total Weight: 18.5 / linear yard, Battalion Headquarters Building (7076) and Brigade Headquarters Building (7078).

2.2 PRIMER AND ADHESIVE

Primer and adhesive shall be mildew resistant and of a type recommended by the wall covering manufacturer.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Wall covering shall not be applied to surfaces that are rough, that contain stains that will bleed through the wall covering, or that are otherwise unsuitable for proper installation. Cracks and holes shall be filled and rough spots shall be sanded smooth. Surfaces to receive wall covering shall be thoroughly dry. Plaster surfaces shall age at least 30 days prior to installation of vinyl wall coverings. Moisture content of plaster, concrete, and masonry shall be tested with an electric moisture meter and reading shall be not more than 5 percent. Masonry walls shall have flush joints. Concrete and masonry walls shall be coated with a thin coat of joint compound or cement plaster as a substrate preparation. To promote adequate adhesion of wall lining over masonry walls, the walls shall be primed as recommended by the wall lining manufacturer. Surface of walls shall be primed as required by manufacturer's instructions to permit ultimate removal of wall covering from the wall surface. Primer shall be allowed to completely dry before adhesive application.

3.2 INSTALLATION

3.2.1 Wall Lining

Wall lining shall be installed over masonry walls that are to receive wall covering. Lining shall be installed in accordance with the manufacturer's installation instructions. Lining shall be installed perpendicular to wall covering to prevent overlapping of seams between lining and wall covering.

3.2.2 Vinyl and Fabric Wall Covering

Wall covering shall be installed in accordance with the manufacturer's installation instructions. Fabric wall covering shall be installed using a new, clean, very sharp blade for each cut to prevent fraying of wall covering seams. Glue and adhesive spillage shall be immediately removed from wall covering face and seams with a remover recommended by the manufacturer. After the installation is complete, the fabric wall covering shall be

thoroughly vacuumed with a ceiling to floor motion.

3.3 CLEAN-UP

Upon completion of the work, wall covering shall be left clean and free of dirt or soiling.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 09950
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. SD-01 Data										
		1	Wall Covering and Accessories; FIO.										
			SD-06 Instructions										
		2	Installation; FIO.										
		3	Maintenance; FIO.										
			SD-14 Samples										
		4	Wall Covering and Accessories; GA.										

SAFETY PAYS

SECTION 09960

WATER REPELLENT STAIN

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SAFETY PAYS

SECTION 09960

WATER REPELLENT STAIN

PART 1 GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 96	Test Methods for Water Vapor Transmission
ASTM C 140	Water Absorption

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Pigmented Water Repellent Stain; GA.

Water Repellent Primer; GA

Submit manufacturer's product data sheets on all products to be used for the work. Submit description for protection of surrounding areas and nonmasonry surfaces, surface preparation, application, and final cleaning.

SD-08 Statements

Pigmented Water Repellent Stain; FIO.

Water Repellent Primer; FIO

Submit qualifications of applicator. Certification stating applicator is experienced in the application of the specified products. List of recently completed water repellent stain projects, including project name and location, names of owner and architect, and description of products used, substrates, applicable local environmental regulations, and application procedures.

SD-13 Certificates

Pigmented Water Repellent Stain; FIO.

Water Repellent Primer; FIO

Submit certification that water repellent stain furnished complies with regulations controlling use of volatile organic compounds (VOC).

SD-18 Records

Pigmented Water Repellent Stain; FIO.

Water Repellent Primer; FIO

Submit applicable local environmental regulations.

1.3 GENERAL REQUIREMENTS

Application of pigmented water repellent stain shall protect above-grade, vertical split faced masonry surfaces. Primer and Finish coats shall be the same manufacturer.

1.4 QUALITY ASSURANCE

Applicator shall be trained experienced in the application of the specified products.

Pre-application meeting shall be conducted before the start of application of water repellent stain. Require attendance of parties directly affecting work of this section, including the Contractor, Contracting Officer, applicator, and Manufacturer's representative. Review environmental regulations, test panel procedures, protection of surrounding areas and nonmasonry surfaces, surface preparation, application, field quality control, final cleaning, and coordination with other work.

1.5 ENVIRONMENTAL REGULATIONS

Comply with applicable federal, state, and local environmental regulations.

1.6 TEST PANELS

Before full-scale application, review manufacturer's product data sheets to determine the suitability of the primer and stain for the split faced CMU. Apply water repellent primer and stain to test panels to determine number of applications, coverage rates, compatibility, effectiveness, surface preparation, application procedures, and desired results.

Apply water repellent primer and stain to test panels in accordance with manufacturer's written instructions. Allow 48 hours or until test panels are thoroughly dry before evaluating final appearance and results. Do not begin full-scale application until test panels are inspected and approved by the Contracting Officer.

Test Panel Requirements:
Size: Minimum 1200 mm by 1200 mm each.
Locations: As determined by the Contracting Officer.
Number: As required to completely test water repellent stain.

Retain and protect test panels approved by the Contracting Officer in undisturbed condition during the work of this section, to be used as a standard for judging the water repellent stain work.

1.7 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

Store containers upright in a cool, dry, well ventilated place, out of the sun. Store away from all other chemicals and potential sources of contamination. Keep lights, fire, sparks, and heat away from containers. Do not drop containers or slide across sharp objects. Keep containers tightly closed when not in use. Store and handle materials in accordance with manufacturer's written instructions.

1.8 PROJECT CONDITIONS

a. Do not apply at surface and air temperatures below 40EF or above 95EF, unless otherwise indicated by manufacturer's written instructions. Do not apply when surface and air temperatures are not expected to remain above 40EF for a minimum of 24 hours after application, unless otherwise indicated by manufacturer's written instructions.

b. Do not apply under windy conditions such that water repellent stain may be blown to surfaces not intended.

c. Do not apply to frozen substrate. Allow adequate time for substrate to thaw, if freezing conditions exist before application.

d. Do not apply earlier than 24 hours after rain or if rain is predicted for a period of 8 hours after application, unless otherwise indicated by manufacturer's written instructions.

1.9 WARRANTY

Manufacturer shall warrant the water repellent primer and stain system for a period of five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 WATER REPELLENT STAIN

Acrylic/silicone elastomer coating shall be a breathable, semi-opaque stain that will uniformly color and weather-proof split faced masonry; provides UV and color stability, and prevents water penetration through exterior walls exposed to weathering.

Form: Liquid.
Color: Pigmented.
Specific Gravity: 1.018
Active Substance: Acrylic Silicone Resin.
Total Solids: 20%.
Flash Point: >212EF (>100EC)
Solvent: Water
VOC: 107 Grams per Liter
Breathability: 87% Retention, ASTM E 96, Water Method
Coverage Rate: 125-175 Sq. Ft. per coat

2.2 WATER REPELLENT PRIMER

Siloxane Microemulsion Water Repellent shall be self-emulsifying, penetrating water repellent concentrate designed for dilution with fresh water at the job site. Consult Product Data for split faced CMU specific dilution ratio. Water repellent shall chemically bond with the split faced masonry to provide increased adhesion of the Acrylic/silicone elastomer coating.

Form: Liquid.
Color: Clear, amber liquid.
Specific Gravity: 1.000.
Active Substance: Microemulsion concentrate of silanes and oligomeric alkylalkoxy siloxanes.
Percent Active Material: 100%.
VOC: 318 grams per liter (ASTM D 5095/ASTM D 3960).
Flash Point: 77EF (25EC).

PART 3 EXECUTION

3.1 EXAMINATION

Verify by examination that split faced CMU surfaces are acceptable to receive the water repellent primer and stain. Notify the Contracting Officer if split face CMU is not acceptable to receive the water repellent stain.

3.2 PROTECTION

Protect surrounding areas, landscaping, building occupants, pedestrians, vehicles, and nonmasonry surfaces during the work from contact with the water repellent stain, residues, rinse water, fumes, wastes, and effluents in accordance with manufacturer's written instructions.

3.3 SURFACE PREPARATION

Clean all dirt, dust, oil, grease, and other contaminants from split faced CMU that interfere with penetration or performance of water repellent stain. Use appropriate masonry cleaners approved by the water repellent stain manufacturer where necessary. Rinse thoroughly using pressure water spray to remove cleaner residues. Allow split faced CMU to dry completely before application of water repellent stain.

Repair, patch, and fill all cracks, voids, defects, and damaged areas in split faced CMU as approved by the Contracting Officer. Allow repair materials to cure completely before application of water repellent stain.

Apply specified sealants and caulking and allow to cure completely before application of water repellent stain.

Seal all open joints.

Allow new masonry construction and repointed surfaces to cure for minimum of 28 days before application of water repellent stain.

3.4 APPLICATION

Apply water repellent primer and two coats of stain to split faced CMU in accordance with manufacturer's written instructions, environmental regulations, and application procedures determined from test panel results approved by the Contracting Officer.

3.4.1 Coating Thickness

a. Minimum wet film thickness of first coat shall be 7 mils.

b. Minimum wet film thickness of second coat shall be 7 mils.

c. Minimum total dry film thickness shall be 2.5 mils

3.4.2 Special Precautions

a. Apply to clean, dry, cured, and properly prepared surfaces approved by the Contracting Officer.

b. Consult manufacturer's written instructions for information on application equipment to be used and precautions to be taken with the primer and stain.

c. Do not dilute or alter water repellent stain unless otherwise specified. Dilute Siloxane Microemulsion Water Repellent with clean, potable water at the site in accordance with manufacturer's written instructions.

d. Do not apply to below-grade surfaces.

e. Avoid over spray, wind drift, and splash of water repellent primer and stain.

3.5 FIELD QUALITY CONTROL

3.5.1 Inspection

Inspect the water repellent stain work with the Contractor, Contracting Officer, applicator, and Manufacturer's representative, and compare with test panel results approved by the Contracting Officer. Determine if the split faced CMU is suitably protected by the water repellent stain.

3.5.2 Manufacturer's Field Services

Manufacturer's authorized field representative shall verify protection, surface preparation, and application of water repellent stain are in accordance with the manufacturer's written instructions and the test panel results approved by the Contracting Officer.

3.6 FINAL CLEANING

Clean site of all unused water repellent stain residues, rinse water, wastes, and effluents in accordance with environmental regulations.

Remove and dispose of all materials used to protect surrounding areas and nonmasonry surfaces, following completion of the work of this section.

Repair, restore, or replace to the satisfaction of the Contracting Officer, all materials, landscaping, and nonmasonry surfaces damaged by exposure to water repellent stain.

3.7 SCHEDULE

Water repellent primer and stain shall be applied after completion of exterior work and is not subject to damage by construction activities.

END OF SECTION

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 09960
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO.	TRANS-MITTAL NO.	ITEM NO.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER	REV-IEW-ER	SUBMIT	APPROV. NEEDED BY	MATER. NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
a.	b.	c.	d. through q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
			PAR. NO. SD-01 Data										
		1	Pigmented Water Repellent Stain; GA.										
			SD-08 Statements										
		2	Pigmented Water Repellent Stain; FIO.										
			SD-13 Certificates										
		3	Pigmented Water Repellent Stain; FIO.										
			SD-18 Records										
		4	Pigmented Water Repellent Stain; FIO.										

SAFETY PAYS

SECTION 10160

TOILET PARTITIONS
08/94

PART 1 GENERAL 10160-1
1.1 REFERENCES 10160-1
1.2 SYSTEM DESCRIPTION 10160-1
1.3 SUBMITTALS 10160-1
1.4 DELIVERY, STORAGE, AND HANDLING 10160-2
1.5 WARRANTY 10160-2

PART 2 PRODUCTS 10160-2
2.1 TOILET ENCLOSURES 10160-2
2.2 URINAL SCREENS 10160-2
2.3 HARDWARE 10160-2
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SAFETY PAYS

SECTION 10160

TOILET PARTITIONS
08/94

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

CFR 28 Part 36	Americans with Disabilities Act Accessibility Guidelines

FEDERAL SPECIFICATIONS (FS)

FS RR-P-1352	(Rev C) Partitions, Toilet, Complete

FEDERAL STANDARDS (FED-STD)

FED-STD 795	(Basic) Uniform Federal Accessibility Standards

1.2 SYSTEM DESCRIPTION

Toilet partition system, including toilet enclosures, room entrance screens, and urinal screens, shall be a complete and usable system of panels, hardware, and support components. The partition system shall be provided by a single manufacturer and shall be a standard product as shown in the most recent catalog data. The partition system shall comply with FED-STD 795 and CFR 28 Part 36 for areas as shown.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Toilet Partition System; FIO.

Manufacturer's technical data and catalog cuts including installation and cleaning instructions.

SD-04 Drawings

Toilet Partition System; GA.

Drawings showing plans, elevations, details of construction, hardware, reinforcing, fittings, mountings, and anchorings.

SD-14 Samples

Toilet Partition System; GA.

Manufacturer's standard color charts and color samples.

1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants and shall have easy access for inspection and handling.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 TOILET ENCLOSURES

Toilet enclosures shall conform to FS RR-P-1352, Type I, Style A. Width, length and height of toilet enclosures shall be as shown. Finish surface of panels shall be baked enamel finish 1. Panels indicated to receive toilet paper holders, or grab bars or other partition mounted accessories as specified in Section 10800 TOILET ACCESSORIES shall be reinforced for the reception of the items required. Grab bars shall comply with FED-STD 795 and CFR 28 Part 36.

2.2 URINAL SCREENS

Urinal screens shall conform to FS RR-P-1352, Type III, Style A. Finish surface of screens shall be baked enamel finish 1. Width and height of urinal screens shall be as shown.

2.3 HARDWARE

Hardware for the toilet partition system shall conform to FS RR-P-1352 for the specified type and style of partitions. Hardware finish shall be highly resistant to alkalies, urine, and other common toilet room acids.

2.4 COLORS

Color of finishes for toilet partition system components shall be as indicated on the color schedule drawing.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet partitions shall be installed straight and plumb in accordance with approved manufacturer's instructions with horizontal lines level and rigidly anchored to the supporting construction. Where indicated, anchorage to walls shall be by through-bolting. Drilling and cutting for installation of anchors shall be at locations that will be concealed in the finished work. Adjust doors to drift into a closed position when not in use.

3.2 ADJUSTING AND CLEANING

Doors shall have a uniform vertical edge clearance of approximately 5 mm and shall rest open at approximately 30 degrees when unlatched. Baked enamel finish shall be touched up with the same color of paint that was used for the finish. Toilet partitions shall be cleaned in accordance with approved manufacturer's instructions and shall be protected from damage until accepted.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 10160
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. SD-01 Data										
		1	Toilet Partition System; FIO.										
			SD-04 Drawings										
		2	Toilet Partition System; GA.										
			SD-14 Samples										
		3	Toilet Partition System; GA.										

SAFETY PAYS

SECTION 10201

METAL WALL LOUVERS
09/95

PART 1 GENERAL 10201-1
1.1 REFERENCES 10201-1
1.2 SUBMITTALS 10201-2
1.3 DELIVERY, STORAGE, AND PROTECTION 10201-2

PART 2 PRODUCTS 10201-2
2.1 MATERIALS 10201-2
2.2 METAL WALL LOUVERS 10201-2
2.3 FASTENERS AND ACCESSORIES 10201-3
2.4 FINISHES 10201-3

PART 3 EXECUTION 10201-3
3.1 INSTALLATION 10201-3
3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS 10201-4

SAFETY PAYS

SECTION 10201

METAL WALL LOUVERS
09/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 605.2	(1992; Addenda Feb 1994) Voluntary Specification for High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels
AAMA 606.1	(1976) Voluntary Guide Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum
AAMA 608.1	(1977) Voluntary Guide Specifications and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum

AIR MOVEMENT AND CONTROL ASSOCIATION, INC. (AMCA)

AMCA 500	(1991) Test Methods for Louvers, Dampers and Shutters
AMCA 511	(1986) Certified Ratings Program for Air Control Devices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 209M	(1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221M	(1993) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

FEDERAL SPECIFICATIONS (FS)

FS RR-W-365 (Rev A) Wire Fabric (Insect Screening)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Manufacturer's Standard Color Charts

Wall louvers; GA.

Colors of finishes shall closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard colors to the Contracting Officer for selection.

SD-04 Drawings

Wall louvers; GA.

Show all information necessary for fabrication and installation of louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aluminum Sheet

ASTM B 209M, alloy 3003 or 5005 with temper as required for forming.

2.1.2 Extruded Aluminum

ASTM B 221M, alloy 6063-T5 or -T52.

2.2 METAL WALL LOUVERS

Weather resistant type, with insect screens and made to withstand a wind load of not less than 1.44 kilopascals. Wall louvers shall bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500 and AMCA 511. The rating shall show a water penetration of 0.06 kilograms or less per square meter of free area at a free velocity of 244 meters per minute.

2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 2 mm.

2.2.2 Mullions and Mullion Covers

Same material and finish as louvers. Provide mullions where indicated for all louvers more than 1500 mm in width at not more than 1500 mm on centers. Provide mullions covers on both faces of joints between louvers.

2.2.3 Screens and Frames

Provide 1.4 x 1.6 mm aluminum mesh screening conforming with FS RR-W-365, Type VII. Mount screens in removable, rewirable frames of same material and finish as the louvers.

2.3 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers and zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories as required for complete and proper installation.

2.4 FINISHES

2.4.1 Aluminum

2.4.1.1 Anodized Finish

Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.7 mil (0.018 mm) or thicker) complying with AAMA 606.1 or AAMA 608.1. Color shall be dark bronze.

2.4.1.2 High-Performance Organic Coating

Exposed surfaces of aluminum louvers and frames shall be factory finished with a two-coat fluoropolymer coating system containing at least 70 percent by weight polyvinylidene fluoride, PVF2 resin, factory-applied, oven-baked, conforming to AAMA 605.2, with a primer coat of 0.005 to 0.008 mm and a color coat of minimum 0.025 mm, total dry film thickness of 0.030 to 0.033 mm. Finish shall be free of scratches and other blemishes. Provide louvers and frames in color to match exterior wall panels in which louvers are located.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

3.1.2 Screens and Frames

Attach frames to louvers with screws or bolts.

3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

3.2.1 Copper or Copper-Bearing Alloys
Paint copper or copper-bearing alloys in contact with dissimilar metal with heavy-bodied bituminous paint or separate with inert membrane.

3.2.2 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

3.2.3 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 10201
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-03 Manufacturer's Standard Color Charts										
		1	Wall louvers; GA.										
			SD-04 Drawings										
		2	Wall louvers; GA.										

SAFETY PAYS

SECTION 10260

WALL AND CORNER PROTECTION
02/92

PART 1 GENERAL 10260-1
1.1 REFERENCES 10260-1
1.2 SUBMITTALS 10260-1
1.3 DELIVERY AND STORAGE 10260-2

PART 2 PRODUCTS 10260-2
2.1 GENERAL 10260-2
2.2 CORNER GUARDS 10260-3
2.3 WALL GUARDS (BUMPER GUARDS / CRASH RAILS) 10260-3
2.4 FASTENERS AND ANCHORS 10260-4
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PART 3 EXECUTION 10260-4
3.1 INSTALLATION 10260-4

SAFETY PAYS

SECTION 10260

WALL AND CORNER PROTECTION
02/92

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(1980; R 1993) Designation System for Aluminum Finishes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM D 256	(1993a) Determining the Pendulum Impact Resistance of Notched Specimens of Plastics
ASTM D 635	(1996) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM E 84	(1996a) Surface Burning Characteristics of Building Materials

FEDERAL STANDARDS (FED-STD)

FED-STD 795	(Basic) Uniform Federal Accessibility Standards

SOCIETY OF AMERICAN AUTOMOTIVE ENGINEERS (SAE)

SAE J1545	(1986) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Color Trim

UNDERWRITERS LABORATORIES (UL)

UL-01	(1994; Supple) Building Materials Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330SUBMITTAL

PROCEDURES:

SD-01 Data

Corner Guards; FIO.

Wall Guards (Bumper Guards); FIO.

Manufacturer's descriptive data, catalog cuts, and installation instructions, and recommended cleaning instructions.

SD-04 Drawings

Corner Guards; GA. (Barracks Building Only)
Corner Guards; FIO. (All Other Buildings)

Wall Guards (Bumper Guards); GA. (Barracks Building Only)
Wall Guards (Bumper Guards); FIO. (All Other Buildings)

Drawings indicating locations and typical elevations of each type of item. Drawings shall show vertical and horizontal dimensions, full size sections, thickness of materials, and fastening details.

SD-13 Certificates

Corner Guards; FIO.

Wall Guards (Bumper Guards); FIO.

Statements attesting that the items comply with specified fire and safety code requirements.

SD-14 Samples

Finish; GA.

Manufacturer's standard samples indicating color and texture of materials requiring color and finish selection. Color as indicated on color schedules on the drawings.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Materials shall be kept dry, protected from weather and damage, and stored under cover. Materials shall be stored at approximately 21 degrees C for at least 48 hours prior to installation.

PART 2 PRODUCTS

2.1 GENERAL

To the maximum extent possible, corner guards, and wall guards (bumper guards), shall be the standard products of a single manufacturer and shall be furnished as detailed. Drawings show general configuration of products required, and items differing in minor details from those shown will be acceptable.

2.1.1 Resilient Material

Resilient material shall consist of extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic and shall conform to the following:

2.1.1.1 Minimum Impact Resistance

Minimum impact resistance shall be 960.8 N.m/m when tested in accordance with ASTM D 256.

2.1.1.2 Fire Rating

Fire rating shall be Class 1 when tested in accordance with ASTM E 84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less. Material shall be rated self extinguishing when tested in accordance with ASTM D 635. Material shall be labeled and tested by Underwriters Laboratories or other approved testing laboratory. Resilient material used for protection on fire rated doors and frames shall be listed in UL-01 or equal listing by other approved independent testing laboratory performing the tests.

2.1.1.3 Integral Color

Colored components shall have integral color and shall be matched in accordance with SAE J1545 to within plus or minus 1.0 on the CIE-LCH scales.

2.2 CORNER GUARDS

2.2.1 Resilient Corner Guards

Corner guard units shall be surface mounted type, radius formed to profile shown. Corner guards shall extend from top of wall base to ceiling. Mounting hardware, cushions, and base plates shall be furnished. Assembly shall consist of a snap-on corner guard formed from resilient material, minimum 1.98 mm thick, mounted on a continuous retainer. Extruded aluminum retainer shall conform to ASTM B 221, alloy 6063, temper T5 or T6. Factory fabricated end closure caps shall be furnished for top and bottom of surface mounted corner guards. Insulating materials that are an integral part of the corner guard system shall be provided by the manufacturer of the corner guard system. Exposed metal portions of fire rated assemblies shall have a paintable surface.

2.2.2 Stainless Corner Guards

Stainless steel corner guards shall be fabricated of 1.58mm thick material conforming to ASTM A 167, type 302 or 304. Corner guards shall extend from floor to ceiling except as noted otherwise. Corner guard shall be formed to dimensions shown.

2.3 WALL GUARDS (BUMPER GUARDS / CRASH RAILS)

2.3.1 Wall Guards

Wall guards shall be provided with prefabricated end closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories standard with the manufacturer. Extruded aluminum retainers shall conform to ASTM B 221, alloy 6063, temper T5 or T6. End caps and corners shall be field adjustable to assure close alignment with handrails and wall guards.

2.3.1.1 Wall Guards Materials

Wall guards shall consist of snap-on covers of resilient material, minimum 1.98 mm thick, mounted over 28.6 mm wide aluminum, minimum 1.57 mm thick retainer, anchored to wall at height indicated on drawings.

2.4 FASTENERS AND ANCHORS

Fasteners and anchors shall be provided for each specific installation.

2.5 FINISH

2.5.1 Aluminum Finish

Finish for aluminum shall be in accordance with AA DAF-45. Exposed aluminum shall be designation AA-C22A31 chemically etched medium matte, with clear anodic coating class II architectural coating 0.010 mm thick. Concealed aluminum shall be mill finish.

2.5.2 Resilient Material Finish

Finish for resilient material shall be embossed texture with colors in accordance with SAE J1545 and as indicated on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Corner Guards and Wall Guards (Bumper Guards / Crash Rails)

Material shall be mounted at location indicated in accordance with manufacturer's recommendations.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 10260
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO.										
			SD-01 Data										
		1	Corner Guards; FIO.										
		2	Wall Guards (Bumper Guards); FIO.										
			SD-04 Drawings										
		3	Corner Guards; GA.										
		4	Corner Guards; FIO.										
		5	Wall Guards (Bumper Guards); GA.										
		6	Wall Guards (Bumper Guards); FIO.										
			SD-13 Certificates										
		7	Corner Guards; FIO.										
		8	Wall Guards (Bumper Guards); FIO.										
			SD-14 Samples										
		9	Finish; GA.										

SAFETY PAYS

SECTION 10430

EXTERIOR SIGNAGE
05/95

PART 1 GENERAL 10430-1
1.1 REFERENCES 10430-1
1.2 GENERAL 10430-2
1.3 SUBMITTALS 10430-2
1.4 DELIVERY AND STORAGE 10430-3

PART 2 PRODUCTS 10430-3
2.1 COLOR 10430-3
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2.3 ORGANIC COATING 10430-3
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SAFETY PAYS

SECTION 10430

EXTERIOR SIGNAGE
05/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(1980) Designation System for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(1994) Safety Glazing Materials Used in Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 525	(1993) General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM B 26	(1992a) Aluminum-Alloy Sand Castings
ASTM B 108	(1992a) Aluminum-Alloy Permanent Mold Castings
ASTM B 209	(1992a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	(1993) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM D 3841	(1992) Glass-Fiber-Reinforced Polyester Plastic Panels
ASTM E 84	(1994) Surface Burning Characteristics of Building Materials

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1994) Structural Welding Code - Steel

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 505	(1988) Metal Finishes Manual for Architectural and Metal Products; Section: Applied Coatings

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 3611	(1964; Rev C) Plastic Sheet, Polycarbonate General Purpose

1.2 GENERAL

Exterior signage shall be of the size and type shown on the drawings, shall conform to the requirements specified herein, and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Materials and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Exterior Signs; FIO.

Manufacturer's descriptive data, catalog cuts, and installation instructions.

SD-04 Drawings

Exterior Signs; GA.

Drawings showing elevations of each type of sign; dimensions, details, and methods of mounting or anchoring; shape and thickness of materials; and details of construction. A schedule showing the location of each sign type shall be included.

SD-06 Instructions

Exterior Signs; FIO.

Manufacturer's installation instructions and cleaning instructions.

SD-14 Samples

Exterior Signs; GA.

One sample of each type of sign. Each sample shall consist of a complete sign panel with letters and symbols. Samples may be installed in the work, provided each sample is identified and location recorded.

1.4 DELIVERY AND STORAGE

Materials shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area.

PART 2 PRODUCTS

2.1 COLOR

Color of products shall be as indicated on drawings signage schedule.

2.2 ALUMINUM ALLOY PRODUCTS

Aluminum alloy products shall conform to ASTM B 209 for sheet or plate, ASTM B 221 for extrusions and ASTM B 26 or ASTM B 108 for castings. Aluminum extrusions shall be provided at least 3 mm thick and aluminum plate or sheet at least 1.3 mm thick.

2.2.1 Anodic Coating

Anodized finish shall conform to AA DAF-45 as follows:

a. Clear (natural) designation AA-M10-C22-A31, Architectural Class II 0.010 mm or thicker.

b. Integrated color anodized designation AA-M10-C22-A32, Architectural Class 0.010 to 0.018 mm.

c. Electrolytically deposited color - anodized designation AA-M10-C22-A34, Architectural Class II 0.010 to 0.018 mm.

2.3 ORGANIC COATING

Surfaces shall be cleaned, primed, and given a semi-gloss baked enamel or two-component acrylic polyurethane finish in accordance with NAAMM AMP 505 with total dry film thickness not less than 0.030 mm.

2.4 FIBER-REINFORCED POLYESTER (FRP)

Fiber-reinforced polyester (FRP) shall be in accordance with ASTM D 3841, Type II, Grade 1, Class 124, as indicated.

2.5 ACRYLIC SHEET

Acrylic sheet shall be in accordance with the flammability requirements of ASTM E 84 and shall conform to ANSI Z97.1.

2.6 POLYCARBONATE SHEET

Polycarbonate sheet shall conform to SAE AMS 3611.

2.7 RIGID PVC FOAM BOARD PRODUCTS

Rigid PVC foam board for sign type B2 panels shall be 6.4 mm thick Trovicel by Huls America, Inc. or equal product which meets physical properties and flammability standards of Travicel.

2.8 ANCHORS AND FASTENERS

Exposed anchor and fastener materials shall be compatible with metal to which applied and shall match in color and finish.

2.9 SHOP FABRICATION AND MANUFACTURE

2.9.1 Workmanship

Work shall be assembled in the shop, insofar as practicable, ready for installation at the site. Work that cannot be shop assembled shall be given a trial fit in the shop to ensure proper field assembly. Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Welding to or on structural steel shall be in accordance with AWS D1.1. Welding shall be continuous along the entire area of contact. Exposed welds shall be ground smooth. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable. Items specified to be galvanized shall be by hot-dip process after fabrication if practicable. Galvanization shall be in accordance with ASTM A 123 and ASTM A 525, as applicable. Joints exposed to the weather shall be formed to exclude water. Drainage and weep holes shall be included as required to prevent condensation buildup.

2.9.2 Dissimilar Materials

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of asphalt varnish or a coat of zinc-molybdate primer to prevent galvanic or corrosive action.

2.9.3 Shop Painting

Surfaces of miscellaneous metal work, except nonferrous metal, corrosion resisting steel, and zinc-coated work, shall be given one coat of zinc-molybdate primer or an approved rust-resisting treatment and metallic primer in accordance with manufacturer's standard practice. Surfaces of items to be embedded in concrete shall not be painted. Upon completion of work, damaged surfaces shall be recoated.

2.10 PANEL AND POST/PANEL TYPE SIGNS

2.10.1 Posts

One-piece aluminum posts shall be provided with minimum 3.17 mm wall thickness. Posts shall be designed to accept panel framing system described herein. The post shall be designed to permit attachment of panel framing system without exposed fasteners. Caps shall be provided for each post.

2.10.2 Panel Framing System

Panel framing consisting of aluminum sections and interlocking track components shall be designed to interlock with posts with concealed fasteners. Top and bottom framing members shall be removable to permit panel

removal.

2.10.3 Panels

Modular message panels shall be provided in sizes shown on drawings. Panels shall be fabricated a minimum of 6.4 mm PVC foam board "Travicel" by Huls America or equal product. Panels shall be designed to be interchangeable 3M "Scotchal" film coating and vinyl letters will be Government furnished and Government installed on panels after post and panel type B2 signs are contractor installed.

2.10.4 Finishes

Post, angle and metal panel framing finish shall be anodized conforming to AA DAF-45, dark bronze tone.

2.10.5 Mounting

Permanent mounting shall be provided by embedding posts in concrete foundation as shown.

2.11 GRAPHICS FOR POST/PANEL TYPE SIGNS

2.11.1 Graphics

Signage graphics shall conform to the following:

a. See 2.10.3 for sign type B2 graphics.

b. Message shall be applied to sign type B5 using the silkscreen process. Silk screened images shall be executed with photo screens prepared from original art. No handcut screens will be accepted. Edges and corners shall be clean. Rounded corners, cut or ragged edges, edge buildup, bleeding or surfaces pinholes will not be accepted.

2.11.2 Messages

See drawings and schedule for message content. Typeface: Helvetica medium. Type size as indicated.

2.12 DIMENSIONAL BUILDING LETTERS

2.12.1 Fabrication

Letters shall be fabricated from cast aluminum. Letters shall be cleaned by chemical etching or cleaned ultrasonically in a special degreasing bath. Letters shall be packaged for protection until installation.

2.12.2 Typeface

Typeface shall be helvetica medium.

2.12.3 Size

Letter size shall be as indicated.

2.12.4 Finish

Anodized AA-M12C22A32 or AA-M12C22A34 (AA DAF-45), brushed aluminum finish shall be provided.

2.12.5 Mounting

Threaded studs, of number and size as recommended by manufacturer, shall be secured in quick-setting mortar for concealed anchorage. Letters which project from the building line shall have stud spacer sleeves. Letters, studs, and sleeves shall be of the same material. Templates for mounting shall be supplied.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed in accordance with approved manufacturer's instructions at locations shown on the drawings. Confirm locations with Contracting Officer. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Signs mounted on other surfaces shall not be installed until finishes on such surfaces have been completed.

3.1.1 Anchorage

Anchorage shall be in accordance with approved manufacturer's instructions. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood.

3.1.2 Protection and Cleaning

The work shall be protected against damage during construction. Hardware shall be adjusted for proper operation. Frames and other sign surfaces shall be cleaned in accordance with manufacturer's instructions.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 10430
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-01 Data										
		1	Exterior Signs; FIO.										
			SD-04 Drawings										
		2	Exterior Signs; GA.										
			SD-06 Instructions										
		3	Exterior Signs; FIO.										
			SD-14 Samples										
		4	Exterior Signs; GA.										

SAFETY PAYS

***** SAFETY PAYS *****

SECTION 10440

INTERIOR SIGNAGE AND NEON SIGNAGE
05/95

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SECTION 10440

INTERIOR SIGNAGE AND NEON SIGNAGE
05/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(1980) Designation System for Aluminum Finishes
AA PK-1	(1989) Registration Record of Aluminum Association Alloy Designations and Chemical Composition Limits for Aluminum Alloys in the Form of Castings and Ingot
AA SAA-46	(1978) Standards for Anodized Architectural Aluminum

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(1984; R 1984) Safety Glazing Materials Used in Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	(1993) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

CODE OF FEDERAL REGULATIONS (CFR)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

FEDERAL STANDARDS (FED-STD)

FED-STD 795	(Basic) Uniform Federal Accessibility Standards

UNDERWRITERS LABORATORIES (UL)

UL 2161	(1996) UL Standard For Safety for Neon Transformers and Power Supplies

1.2 GENERAL

Interior signage shall be of the sizes and types shown on the drawings, shall conform to the requirements specified herein, and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Signs shall be the standard

product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Interior Signage; FIO.

Manufacturer's descriptive data, catalogs cuts, installation and cleaning instructions.

SD-04 Drawings

Interior Signage; FIO.

Drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, shape and thickness of materials, and details of construction. A schedule showing the location of each sign type shall be included.

SD-14 Samples

Interior Signage; GA.

One sample of each of the following sign types showing typical quality and workmanship. The samples may be installed in the work, provided each sample is identified and location recorded.

a. Direction sign.

b. Door sign.

c. Building directory.

d. Neon sign.

Two samples of manufacturer's standard color chips for each material as indicated on the drawing signage.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area.

1.5 EXTRA STOCK

The Contractor shall provide extra stock of the following: 50 blank plaques of color and size for sign types BB2, 200 changeable message strips for sign type BB2 and 600 changeable message strips for CC1a.

PART 2 PRODUCTS

2.1 COLOR

Color shall be as indicated on the signage schedule.

2.2 ALUMINUM ALLOY PRODUCTS

Aluminum extrusions shall be at least 3 mm thick, and aluminum plate or sheet shall be at least 1.3 mm thick. Extrusions shall conform to ASTM B 221; plate and sheet shall conform to ASTM B 209. Where anodic coatings are specified, alloy shall conform to AA PK-1 alloy designation 514.0. Exposed anodized aluminum finishes shall be as shown and shall conform to AA SAA-46.

2.2.1 Anodic Coating

Anodized finish shall conform to AA DAF-45 as follows:

a. Integral color anodized designation AA-M10-C22-A32, Architectural Class 0.010 to 0.018 mm. Color shall be dark bronze on building map, directory and bulletin board frames.

2.3 ACRYLIC SHEET

Acrylic sheet for panels and components shall conform to ANSI Z97.1.

2.4 PLAQUE SIGNS

Plaque signs shall be a modular type signage system. Signs shall be fabricated of acrylic plastic conforming to ANSI Z97.1.

2.4.1 Standard Modular Plaque Signs

Plaque signs shall consist of matte finish acrylic plastic, thickness and size as shown. Corners of signs shall be squared.

2.4.2 Modular Changeable Message Strip Plaque Signs

Changeable message strip plaque signs shall consist of cast acrylic back laminated to matte finish laminated thermosetting Type ES plastic face with message slots, as detailed, for insertion of changeable message strips. Thickness and size of signs shall be as shown on the drawings. Individual 1.6 mm thick message strips to permit removal, change, and reinsertion shall be provided as detailed. Corners of signs shall be squared.

2.4.3 Type of Mounting For Plaque Signs

Surface mounted signs shall be provided with 1.6 mm thick vinyl foam tape. Sign inserts shall be provided with 1.6 mm thick foam tape.

2.5 GRAPHICS

2.5.1 Tactile Graphics

Signage that provides permanent general circulation directions, or identification of spaces shall be tactile (perceptible to touch) and shall comply with 36 CFR 1191. The 36 CFR 1191 requirements must provide equal or greater accessibility than the requirements of FED-STD 795. Characters, symbols, or pictographs on tactile signs shall meet 36 CFR 1191 Grade 2 braile. Characters and symbols shall contrast with their background.

2.5.2 Graphics Application

Signage graphics shall conform to the following:

a. Message shall be applied to panel using the silkscreen process. Silkscreened images shall be executed with photo screens prepared from original art. No handcut screens will be accepted. Edges and corners shall be clean.

b. Tactile characters and symbols shall be raised 0.8 mm minimum from the sign face. Signs shall be of one piece construction. Add-on characters are not acceptable.

2.5.3 Messages

See drawings and schedule for message content, Typeface: Helvetica medium. Type size as indicated.

2.5.4 Symbols

All symbols shall be based on Depart of Transportation Standards. Color to match text color.

2.6 CHANGEABLE STRIP BUILDING DIRECTORIES

2.6.1 Changeable Strip Directories

2.6.1.1 Header Panel

Header panel shall be acrylic with raised acrylic letters.

2.6.1.2 Doors

2.6.1.3 Door Glazing

Door glazing shall be acrylic SAR 4.8 mm thick or tempered glass.

2.6.1.4 Door Construction

Extruded aluminum door frame shall be of same finish as surrounding frame. Corners shall be mitered welded, and assembled with concealed fasteners. Hinges shall be full length piano hinge type, in finish to match frames and trim. Glazing shall be set in frame with resilient glazing channels. Provide two doors for clear view and access.

2.6.1.5 Door Locks

Door locks shall be manufacturer's standard, and shall be keyed alike. Lock finish shall match the door finish.

2.6.1.6 Fabrication

Extruded aluminum frames and trim shall be assembled with corners welded and mitered to a hairline fit, with no exposed fastners. Removable changeable directory panel shall consist of fiberboard back with wool 6 channels for plastic inserts.

2.6.2 Building Map with Directory

Building map with directory shall be provided with changeable directory listing consisting of the areas and personnel located within the barracks facilities. Building map/directory shall be non-illuminated surface wall mounted type complete with components by a single manufacturer. Building map section shall illustrate all floors of the barracks building and a "You Are Here" location. Apply building map using silkscreen process. Silkscreen images shall be executed with photo screens prepared from the original drawings. No handcut screens will be accepted. Edges and corners shall be clean. Coordinate building map with the Contracting Officer.

Building directory section shall be equipped with six channels and a minimum of 450 blank plastic message strips to complete all spaces. Provide to the Owner a Brothers Model TC34Z or equal electronic labelling system with a 9.5 mm high tape to make listing of barracks occupants in 4.7 mm high letters. Tape name of each occupant will be applied by the Owner to plastic message insert for directory listing.

2.7 CHANGEABLE LETTER BUILDING DIRECTORIES

2.7.1 Changeable Letter Directories

Changeable letter building directories shall be provided with a changeable directory listing consisting of the areas, offices and personnel located within the facility. The changeable directory board shall be 850 mm high and have a width in 600 mm increments, and shall have a 250 mm high continuous header. Width of sign shall be as shown on the drawings. Colors shall be white letters and numbers on a dark brown felt or vinyl grooved background. Message content shall be as shown.

2.7.1.1 Header Lettering

Building or military unit name letters shall be upper and lower case helvetica medium, 50 mm high capital letter, flush left. Service name letters shall be upper and lower case helvetica regular 50 mm high capital letter, flush left.

2.7.1.2 Changeable Directory Letters

Changeable letters shall be upper and lower case helvetica medium. Tabbed vinyl letters and numbers shall be furnished in accordance with the drawings and schedule. Provide a complete set of upper and lower case changeable letters to allow for changes and message replacement, according to manufacturers recommendation.

2.7.1.3 Header Panel

Header panel shall be acrylic with raised acrylic letters.

2.7.1.4 Doors

2.7.1.5 Door Glazing

Door glazing shall be in accordance with ASTM C 1036, Type 1, Class 1, Quality 3, minimum 3 mm thick 4.8 mm thick conforming to clear polycarbonate sheet 4.8 mm thick.

2.7.1.6 Door Construction

Extruded aluminum door frame shall be of same finish as surrounding frame. Corners shall be mitered , reinforced or , welded, and assembled with concealed fasteners. Hinges shall be standard with the manufacturer, in finish to match frames and trim. Provide sliding glazed doors where indicated, according to manufacturers standard. Glazing shall be set in frame with resilient glazing channels.

2.7.1.7 Door Locks

Door locks shall be manufacturer's standard, and shall be keyed alike. Lock finish shall match the door finish.

2.7.1.8 Fabrication

Extruded aluminum frames and trim shall be assembled with corners reinforced or welded and mitered to a hairline fit, with no exposed fastners. Removable changeable directory panel shall consist of plywood back with wool felt vinyl covering backgrooved 6 mm on centers to receive flanged letters.

2.8 BULLETIN BOARDS

2.8.1 Header Panel

Acrylic with raised letters to match header panel of building map/directory.

2.8.2 Tackable Display Area

Tackable facing shall be 3.2 mm cork in color as indicated. Backing shall be burlap on Duracore hardboard. Extruded aluminum frame and trim shall be assembled with hairline fit corners and joints. Anodized frame color shall be dark bronze.

2.9 VINYL LETTERS

Letters to be prespaced, pressure sensitive vinyl. Vinyl to be 3.5 mil thickness. Cutting should be computer controlled for precision; reverse cut for application to the inside surface of glass. Color to be as indicated on drawings.

2.10 NEON SIGNAGE

Neon signage shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate signs that have been in satisfactory usage for at least two years prior to bid opening and shall comply to UL 2161 UL standard. Signage shall be shop fabricated, complete and ready for installation by the manufacturer. Letters shall be directly mounted onto bulkhead after all other work in the immediate vicinity has been completed. Installed signage letters shall be uniform and secured per industry standards. Neon to be produced in units not to exceed 2400mm in length. No unit to be produced less than 450mm in length. The removal of phosphor powder coating at end of tube prior to making weld joints must be limited to .6mm.

2.10.1 Messages

Refer to the Signage Schedule of the Architectural drawings.

2.10.2 Neon Tubing

Tubing shall be 12mm diameter tubing. Color as indicated on the drawings.

2.10.3 Letter Size and Style

Letters shall be 250mm uppercase and 125mm lower case in height, matching Kalif Bold letter style. Alignment of letters shall maintain a horizontal baseline.

2.10.4 Supports

Use only approved supports with 45mm standoff.

2.11 ANCHORS AND FASTENERS

Exposed anchor and fastener materials shall be compatible with metal to which applied and shall have matching color and finish. Anchorage system shall be of the type recommended by the manufacturer of the indicated substrate. Where recommended by signage manufacturer, foam tape pads may be used for anchorage. Foam tape pads shall be minimum 1.5 mm thick closed cell vinyl foam with adhesive backing. Adhesive shall be transparent, long aging, high tech formulation on two sides of the vinyl foam. Adhesive surfaces shall be protected with a 5 mil green flatstock treated with silicone. Foam pads shall be sized for the signage as per signage manufacturers recommendations.

2.12 FABRICATION AND MANUFACTURE

2.12.1 Workmanship

Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable.

2.12.2 Dissimilar Materials

Where dissimilar metals are in contact, the surfaces will be protected to prevent galvanic or corrosive action.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed in accordance with approved manufacturer's instructions at locations shown on the drawings. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Signs on doors or other surfaces shall not be installed until finishes on such surfaces have been installed.

3.1.1 Anchorage

Anchorage shall be in accordance with approved manufacturer's instructions. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood.

3.1.2 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned in accordance with the manufacturer's approved instructions.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION DISCOM Barracks Complex Phase 1, Fort Campbell, KY				CONTRACTOR									SPEC. SECTION 10440	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-01 Data										
		1	Interior Signage; FIO.										
			SD-04 Drawings										
		2	Interior Signage; FIO.										
			SD-14 Samples										
		3	Interior Signage; GA.										

***** SAFETY PAYS *****

SECTION 10505

LOCKERS AND BENCHES
09/95

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SECTION 10505

LOCKERS AND BENCHES
09/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653/A 653M	(1994) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 456	(1994) Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
ASTM D 2092	(1986; R 1993) Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting

FEDERAL SPECIFICATIONS (FS)

FS AA-L-00486	(Rev. J) Lockers, Clothing, Steel

MILITARY SPECIFICATIONS (MIL)

MIL-C-22750	(Rev. E; Am. 1) Coating, Epoxy, VOC-Compliant
MIL-P-23377	(Rev. F) Primer Coatings: Epoxy, Chemical and Solvent Resistant

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Catalog Data; FIO.

Material; FIO.

Finish; FIO.

Components; FIO.

Assembly instructions; FIO.

SD-03 Manufacturer's Standard Color Charts

Color chips; GA.

Provide a minimum of three color chips, not less than 75 mm square, of each color scheduled.

SD-04 Drawings

Types; GA.

Location; GA.

Installation; GA.

Numbering system; GA.

1.3 DELIVERY, HANDLING, AND STORAGE

Deliver lockers and associated materials in their original packages, containers, or bundles bearing the manufacturer's name and the name of the material. Protect from weather, soil, and damage during delivery, storage, and construction.

1.4 FIELD MEASUREMENTS

To ensure proper fits, make field measurements prior to the preparation of drawings and fabrication.

PART 2 PRODUCTS

2.1 LOCKERS

2.1.1 Types

FS AA-L-00486. Provide Type I, single-tier (single unit 381mm W x 457mm D x 1950mm H) lockers in the location and quantities indicated in Battalion Building (7076) and Brigade Building (7078). Provide Type II, double-tier, Style 1, (381mm W x 457mm D x 1950mm H) lockers in the location and quantities indicated in Company Operations Building (7075) and Dining Facility (7048). Provide type II, double tier, style I, size 3 lockers in locations and quantities indicated in the Company Operations Building (7075). Provide locker finish colors as scheduled. Provide lockers "set-up" (pre-assembled).

2.2 MATERIAL

2.2.1 Galvanized Steel Sheet

ASTM A 653/A 653M, commercial quality, minimized spangle, galvanized steel sheet with not less than Z275 zinc coating. Prepare surface of sheet for painting in accordance with ASTM D 2092, Method A. Minimum uncoated sheet thickness as specified.

2.2.2 Chromium Coating

Nickel and chromium electrodeposited on the specified base metal. Conform to ASTM B 456, SC-3, as applicable to the base metal.

2.2.3 Finish

Primer, MIL-P-23377; topcoat, MIL-C-22750.

2.2.3.1 Color

Provide in colors as shown on color schedule drawings.

2.3 COMPONENTS

2.3.1 Built-In Combination Locks

FS AA-L-00486. Provide a combination lock.

2.3.2 Coat Hooks

FS AA-L-00486, zinc plated.

2.3.3 Hanger Rods

FS AA-L-00486.

2.3.4 Door Handles

FS AA-L-00486. Provide zinc alloy or steel handles with a chromium coating.

2.3.5 Doors

FS AA-L-00486, not less than 1.5 mm thick steel sheet.

2.3.5.1 Hinges

In addition to the requirements of FS AA-L-00486, provide 5-knuckle hinges, minimum 50 mm high. Fabricate knuckle hinges from not less than 2 mm thick steel sheet. A full height piano hinge may be provided if standard with the manufacturer. Weld or bolt hinges to the door frame. Weld, bolt, or rivet hinges to the door.

2.3.5.2 Latching Mechanisms

FS AA-L-00486.

2.3.5.3 Louvered Vents
Stamped, louvered vents in door face, as follows:

Single-Tier Lockers: No fewer than 6 louver openings top and bottom.

2.3.6 Latch Strikes

FS AA-L-00486. Fabricate from not less than 2 mm thick steel sheet, except latch strike may be continuous from top to bottom and fabricated as part of the door framing.

2.3.7 Silencers

FS AA-L-00486.

2.3.8 Back and Side Panels, Tops, and Bottoms

FS AA-L-00486, not less than 1.2 mm thick steel sheet.

2.3.9 Shelves

FS AA-L-00486. Fabricate from not less than 1.5 mm thick steel sheet.

2.3.10 Concrete Bases

Concrete bases shall be in accordance with Section 03300 CONCRETE FOR BUILDING CONSTRUCTION.

2.3.11 Number Plates

FS AA-L-00486. Zinc. Provide consecutive numbers specific to each room where lockers are provided.

2.3.12 Fastening Devices

Provide bolts, nuts, and rivets as specified in FS AA-L-00486.

2.3.13 Wood Grounds and Nailing Strips

Wood grounds and nailing strips shall be in accordance with Section 06100 ROUGH CARPENTRY.

2.4 LOCKER BENCHES

2.4.1 Bench Tops

Manufacturer's standard 1-piece units with laminated maple top approximately 240 mm wide by 32 mm thick. Round all corners, sand smooth, and apply manufacturer's standard transparent sealer coating.

2.4.2 Pedestals

Manufacturer's standard steel pedestal supports. Furnish all fastenings and anchorages. Apply manufacturer's standard baked-enamel finish to pedestals.

Type: Manufacturer's standard heavy-duty pedestal with top flange and base, floor anchored.

Color: manufacturer’s standard.

2.5 LAUNDRY AND MUDROOM BENCHES

2.5.1 Bench Tops

The slats in the bench are fabricated from 3 x 24 mm steel bar. frame work shall be die-formed 14 gauge, mitered corners, and measure 19 x 100 mm. Cross bracing will be 3 x 24 mm steel spaced approximately 228 mm apart, with the exception of the mounting brackets which will be fabricated from 6 x 38 mm steel. The seat will be plastic coated to an approximate 5 mm thickness.

2.5.2 Pedestals

Main uprights willl be 100 x 100 mm with 11 guage square tube. Seat supports shall be 60 mm by 12 guage structural steel tube, meeting or surpassing tensile and yield specification for schedule 40 pipe. There shall be a 10 gauge gusset underneath the seat support. Back mounting bracket is 10 gauge die-formed steel. A 100 x 100 mm cast iron ornamental cap will be welded ontop of the uprights. 530 mm is allowed for inground securement. For surface mount applications a 165 x 165 x 6 mm steel plate will be provided. All frames will be finished with a black baked-on polyester powder. All fasteners are zinc plated to resist corrosion.

Type: Manufacture’s standard heavy duty pedestal with steel plate for surface mounting, floor anchored.

Color: See Color Schedule - Special Interior Items on Sheet AAC02 in drawings.

PART 3 EXECUTION

3.1 ASSEMBLY AND INSTALLATION

3.1.1 Lockers

Assemble lockers according to the locker manufacturer's instructions. Align lockers horizontally and vertically. Secure lockers to wall and base with screws as indicated. Bolt adjacent lockers together. Adjust doors to operate freely without sticking or binding and to ensure they close tightly.

Install number plates on lockers consecutively.

3.1.2 Benches

Install benches in accordance with manufacturer's recommendations. Install plumb, level and rigid in locations indicated.

3.2 FIELD QUALITY CONTROL

3.2.1 Testing

Government may request performance-characteristic tests on assembled lockers in accordance with FS AA-L-00486. Lockers not conforming will be rejected.

3.2.2 Repairing

Remove and replace damaged and unacceptable portions of completed work with new.

3.2.3 Cleaning

Clean surfaces of the work, and adjacent surfaces soiled as a result of the work, in an approved manner. Remove equipment, surplus materials, and rubbish from the site.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION DISCOM Barracks Complex Phase 1, Fort Campbell, KY				CONTRACTOR									SPEC. SECTION 10505	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Manufacturer's Catalog Data; FIO.										
		2	Material; FIO.										
		3	Finish; FIO.										
		4	Components; FIO.										
		5	Assembly instructions; FIO.										
			SD-03 Manufacturer's Standard Color Charts										
		6	Color chips; GA.										
			SD-04 Drawings										
		7	Types; GA.										
		8	Location; GA.										
		9	Installation; GA.										
		10	Numbering system; GA.										

***** SAFETY PAYS *****

SECTION 10520

FIRE EXTINGUISHER CABINETS

PART 1 GENERAL 10520-1
1.1 REFERENCES 10520-1
1.2 SUBMITTALS 10520-1

PART 2 PRODUCTS 10520-1
2.1 WALL BRACKETS 10520-1
2.2 CABINETS 10520-1

PART 3 EXECUTION 10520-1
3.1 INSTALLATION 10520-2
--END OF SECTION-- 10520-2

***** SAFETY PAYS *****

SECTION 10520

FIRE EXTINGUISHER CABINETS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10 Portable Fire Extinguishers

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Fire Extinguisher Cabinet; FIO.

Detail drawings shall show plans, elevations, details of construction, gages of metal, hardware, reinforcing, mounting, and anchorings.

PART 2 PRODUCTS

2.1 WALL BRACKETS

Shall be designed to fit extinguishers and shall hold extinguishers firmly and securely in place, but shall provide for easy removal.

2.2 CABINETS

Trimless semi-recessed steel cabinet with baked enamel finish. Steel door shall have factory applied baked enamel color to match adjacent in place walls with glazing to allow the full fire extinguisher to be visible when the door is in a closed position. Cabinet shall be sized to accomodate a 9.5 L, pressurized, water-type fire extinguisher.

2.2.1 CABINET CONSTRUCTION

Cabinet construction shall include:

a. Continuous door hinge
b. Zinc plated pull handle
c. Self-adjusting roller catch
d. Provide one (1) bracket in each cabinet

PART 3 EXECUTION

3.1 INSTALLATION

***** SAFETY PAYS *****

Fire extinguisher cabinets and/or brackets shall be installed as indicated on the drawings.

All fire extinguisher cabinets, and mounting brackets are to be installed at the locations shown on the drawings, or as indicated. Accomplish a neat finished job, consistent with the requirements for the use of the equipment.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION DISCOM Barracks Complex Phase 1, Fort Campbell, KY				CONTRACTOR										SPEC. SECTION 10520
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-04 Drawings										
		1	Fire Extinguisher Cabinet; FIO.										

***** SAFETY PAYS *****

SECTION 10530

MISCELLANEOUS SPECIALTIES

PART 1 GENERAL 10530-1
1.1 REFERENCES 10530-1
1.2 SUBMITTALS 10530-1
1.3 DELIVERY AND STORAGE 10530-2
1.4 WARRANTY 10530-2

PART 2 PRODUCTS 10530-2
2.1 KITCHEN EQUIPMENT (Barracks Building Only) 10530-2
2.2 COURTYARD EQUIPMENT 10530-3
2.3 MAILROOM EQUIPMENT 10530-3
2.4 TENNIS AND BASKETBALL COURT SURFACES 10530-4
2.5 MONITOR MOUNTS 10530-5

PART 3 EXECUTION 10530-5
3.1 INSTALLATION 10530-5
3.2 TENNIS AND BASKETBALL COURTS: 10530-5
3.3 RESURFACER FOR TENNIS AND BASKETBALL COURTS 10530-5
3.4 ACRYLIC COATING FINISH FOR TENNIS AND BASKETBALL COURTS 10530-5
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3.6 CLEANING 10530-5
--END OF SECTION-- 10530-5

SECTION 10530

MISCELLANEOUS SPECIALTIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B38.1

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1006 (1986) Residential Use (Household) Dishwashers

UNDERWRITERS LABORATORIES, INC. (UL)

UL 749 (1995) Household Dishwashers

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Mail Boxes; FIO.

Grill; FIO.

Hood; FIO.

Dishwasher; FIO.

Range; FIO.

Refrigerator; FIO.

Bike Rack; FIO.

Ice Maker; FIO.

Basketball Rim, Backboard and Post; GA.

Tennis net, Posts and cranks; GA.

Monitor Mounts; GA.

Submit manufacturer's product specifications and installation instructions for each item in this section. Submit

operating and maintenance data for kitchen equipment.

SD-04 Drawings

Mail Boxes; GA.

Basketball court; GA.

Tennis court; GA.

Monitor Mounts; GA.

Drawings showing construction and installation details.

SD-14 Samples

Color Charts; GA.

Color selection chart for each item listed under “SD-01”.

1.3 DELIVERY AND STORAGE

All items shall be delivered to the project site in manufacturer's undamaged containers.

1.4 WARRANTY

Provide manufacturer's standard warranty for equipment.

PART 2 PRODUCTS

2.1 KITCHEN EQUIPMENT (Barracks Building Only)

2.1.1 General

Equipment shall be products of same manufacturer for each type of equipment in white color except where noted. All equipment shall be UL listed.

2.1.2 Equipment

2.1.2.1 Built-In Microwave Oven

Mounted built-in microwave oven with minimum 1.1 cubic feet oven capacity and vertical exhaust option. Unit shall be Hotpoint Spacemaker Plus Model JVM230BV or approved equal. Coordinate color selection with adjacent appliances.

2.1.2.2 Exhaust Hood

762mm ducted hood for mounting below wall cabinets, with one- or two-speed fan, permanent washable grease filter and replaceable charcoal odor filter, built-in lighting, baked-on enamel finish.

2.1.2.3 Dishwashing Machine

Household dishwashing machine shall be in accordance with UL ASSE 1006 and sized as indicated.

2.1.2.4 762mm Freestanding Electric Range

Unit with hinged, recessed, porcelain enamel cooktop; 4 plug-in heating elements with infinitely adjustable controls, including not less than on 203mm, 2600 watt element; removable porcelain enamel or chrome plated drip bowls; pyrolithic self-cleaning oven equipped with manually switched light, door with window and safety locking feature, 2 adjustable chrome racks, and porcelain enamel broiler/roaster pan with chrome grille insert; control panel with clock timer, and automatic oven controls; storage drawer below oven; adjustible legs and four foot long grounded 125/250 volt cord.

2.1.2.5 Refrigerator - Top Freezer Type

Freestanding, two door unit; both compartments frostless, with separate temperature controls; switch for condensation control heating element at freezer opening: storage features including adjustible shelves, meat compartment, vegetable crisper(s), butter conditioning compartment, removable egg trays or bins, door shelves, and not less than 2 ice cube trays; reversible doors; adjustible rollers. Freezer and refrigerator compartment doors shall hinge on the right side.

2.1.2.5.1 Capacity

Minimum values, measured according to ANSI B38.1 and certified by AHAM.

2.1.2.5.2 Total Volume

.48 cubic meter refrigerator volume, .40 cubic meter total shelf area, 2.3 square meters.

2.1.2.5.3 Energy Consumption

Measured and certified as follows: Not more than 150 kWh/month under average conditions.

2.1.2.6 Ice Machine

Countertop ice maker-dispenser with ability to control water pressure above 20 psig and below 120 psig, 120 V/60 Hz/single phase with maximum circuit ampacity of 20 and unit shall be air or water cooled.

2.2 COURTYARD EQUIPMENT

2.2.1 Grill Grate:

Flip back cooking grate shall be fabricated from 13 mm round steel, welded to 16 mm steel support bars, with a cooking surface of .32 m2. Grill shall have cool, spring grip handles. Grate shall be sized to match masonry opening.

2.2.2 Bike Rack

Bike rack shall have capacity to secure seven bikes with electrostatically applied .15-.2 mm polyester custom color coating that is oven cured at 204 degrees C bonded to 603 mm ASTM schedule 40 pipe. The unit above-grade height is 915 mm with direct embedment and matching base covers. Bike rack shall be Cycloops model 2170-7-C or approved equal.

2.3 MAILROOM EQUIPMENT

2.3.1 General

Mail boxes shall be U.S. Postal Service approved. Mail boxes, materials, sizes, construction, and installation shall

comply with U.S. Postal Service regulations and shall be fully approved by the U.S. Postal Service.

2.3.2 Mail Boxes

Quantities and arrangement of mail boxes shall be as indicated on the drawings. Mail boxes shall be rear loading type with sheet aluminum removable rear covers strenghtened with formed sheet aluminum stiffeners. Framework supporting compartment doors shall be fabricated from high strength extruded aluminum alloy. Compartment doors shall be fabricated from high strength extruded aluminum alloy, with a minimum of 3.2 mm thickness, and swing on concealed hinge pins. When closed, the door shall interlock with frame member along hinge side and shall be precision fitted to preclude prying. Doors shall be reinforced vertically along both sides and near center with integral ribs. Locks on individual compartment doors shall be springlatch type lock actuated by a cam type lock with two change keys per lock and a minimum of 1000 available key changes. All locks within project shall be keyed differently. Compartment construction shall be double-walled high strength sheet aluminum alloy with vertical stiffeners of formed aluminum. Finish shall be as indicated on the drawings. Mail box manufacturer shall furnish aluminum channel type card holders with pressure sensitive backing to accommodate 11.1 mm by 63.5 mm cards for names and room numbers.

2.3.3 Basketball Equipment

Provide 115 mm schedule 40 galvanized steel vertical post and 1220 mm 90 degree arm to support the basketball backboard. The steel shall be coated after fabrication is complete with triglycidyl isocyanurate powder to match bike rack in color. Provide 914 mm deep by 400 mm diameter bell shaped foundation to support the post and all the basketball equipment. Provide one piece cast aluminum alloy goal with white powder coating. Unit shall be 890 mm by 1270 mm with 38 mm deep supporting flanges and lifetime warrantee. Goal shall be heavy duty for playground use and non-rusting zinc plated steel chain link net. All components shall comply with NCAA dimensions and standards.

2.2.4 Tennis Equipment

Heavy duty posts shall be constructed with steel tube with cap and hooks to support installation of the net specified. Secure unit to concrete slab or provide adequate foundation. The post shall be coated after fabrication is complete with triglycidyl isocyanurate powder with color to match the bike rack. Provide crank for outside installation with tension capacity equal to the net specified. Provide nylon bag of sufficient size to transport and store the net. The net shall be a 12.8 m MacGregor Super Pro Double Center Polyethelene including the center strap (or equal).

2.4 TENNIS AND BASKETBALL COURT SURFACES

2.4.1 Paving Requirements

Paving shall be accomplished in compliance with all requirements in Specification Section 02530, Playing Surfaces For Outdoor Sports Facilities.

2.4.2 Resurfacer for Tennis and Basketball Courts

The resurfacer material shall be an asbestos free acrylic fiberous emulsion meeting the specifications of Dynaflex Acrylic Resurfacer, by Neyra Industries, Inc.(or equal).

2.4.3 Acrylic Coating Finish for Tennis and Basketball Courts

The acrylic coating finish shall be a 100% acrylic, textured, color coating system, for outdoor sports surfaces, meeting the specifications of Dynaflex Acrylic Coatings, by Neyra Industries, Inc. (Or equal).

2.4.4 Finish Color

The color for courts shall be as per color schedule on the drawings. Playing lines shall be white.

2.5 MONITOR MOUNTS

2.5.1 Mounts

Mount to be secured direct to the wall as a single arm style. Mounts platform shall provide 120 degree swivel and 10 degree tilt Platform shall be 610mm by 381mm with ability to secure the monitor onto the platform. Finish shall be scratch resistant black epoxy. Unit shall be a Peerless Monitor Mount model number LWB 375T or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

Install all items in strict accordance with manufacturer's recommendations. Adjust and level kitchen equipment, align and plumb all items with adjacent surfaces and set accurately in location.

Certified applicators for the resurfacer and acrylic coating finish are required by this Contract in order to obtain the manufacturers' 2-year guarantee against abnormal fading and wear. Any other manufacturersubmitted for these materials will be required to supply an equivalent warranty.

3.2 TENNIS AND BASKETBALL COURTS:

After paving, all court surfaces shall be flooded with water to verify surface smoothness requirements, in addition to the straight edging requirements of Specification Section 02530, Playing Surfaces For Outdoor Sports Facilities.

3.3 RESURFACER FOR TENNIS AND BASKETBALL COURTS

A resurfacer shall be placed on all courts to fill voids and provide a smooth surface for the finish color coating. The resurfacer shall be applied to the asphalt surface in accordance with the manufacturers' installation instructions. All courts will be flooded again and checked for surface smoothness requirements prior to receiving the color finish coating.

3.4 ACRYLIC COATING FINISH FOR TENNIS AND BASKETBALL COURTS

All courts shall be coated and lined with an acrylic color finish manufactured for use on outdoor playing courts. The each court shall receive 2 coats in accordance with the manufacturers' installation instructions.

3.5 MONITOR MOUNTS

Mounts shall be secured to the blocking provided. Mounting height shall be as indicated on the drawings. Install the unit in accordance with the manufacturer's recommendation. Coordinate installation with electrical and cable connections.

3.6 CLEANING

Remove all protective wrappings when appropriate to prevent damage during construction. Clean all surfaces in accordance with manufacturer's recommendations.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION MISCELLANEOUS SPECIALTIES				CONTRACTOR										SPEC. SECTION 10530
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Mail Boxes; FIO.										
		2	Grill; FIO.										
		3	Hood; FIO.										
		4	Dishwasher; FIO.										
		5	Range; FIO.										
		6	Refrigerator; FIO.										
		7	Bike Rack; FIO.										
		8	Ice Maker; FIO.										
		9	Basketball Rim, Backboard and Post; GA.										
		10	Tennis net, Posts and cranks; GA.										
		11	Monitor Mounts; GA.										
			SD-04 Drawings										
		12	Mail Boxes; GA.										
		13	Basketball court; GA.										
		14	Tennis court; GA.										
		15	Monitor Mounts; GA.										
			SD-14 Samples										
		16	Color Charts; GA.										

SECTION 10800

TOILET ACCESSORIES
10/94

PART 1 GENERAL 10800-1
1.1 REFERENCES 10800-1
1.2 SUBMITTALS 10800-1
1.3 DELIVERY, STORAGE, AND HANDLING 10800-1

PART 2 PRODUCTS 10800-1
2.1 MANUFACTURED UNITS 10800-2
2.2 ACCESSORY ITEMS 10800-2

PART 3 EXECUTION 10800-6
3.1 INSTALLATION 10800-6
3.2 SCHEDULE 10800-6

SECTION 10800

TOILET ACCESSORIES
10/94

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM-C-1036 (1991) Flat Glass

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-2380 (Basic) Dispenser, Paper Towel

CID A-A-2398 (Rev B) Curtain, Shower and Window (Metric - SI)

FEDERAL SPECIFICATIONS (FS)

FS DD-M-411 (Rev C) Mirrors, Glass

FS WW-P-541/GEN (Rev E; Am 1) Plumbing Fixtures

FS WW-P-541/8 (Rev B; Am 1) Plumbing Fixtures (Accessories, Land Use)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Finishes; GA.

Accessory Items; GA.

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, and operation instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area protected from construction damage and vandalism.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated. Each accessory item shall be complete with the necessary mounting plates, shall be of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall be of tamperproof design and shall be finished to match the accessory.

2.1.2 Finishes

Finishes on metal shall be provided as follows:

Metal	Finish
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

2.2.1 Coat Hook with Bumper (CH/B)

Unit shall be Bobrick Model B-212 or approved equal.

2.2.2 Folding Shower Seat (FSS)

Heavy-duty hinged seat designed to fold up against wall when not in use. Provide support braces, hinges, frame, and fasteners of Type 304 stainless steel. Construct frame of all-welded tubular construction for maximum strength. Provide seat with configuration and seating surface material as follows:

Configuration: L-shaped seat, designed for easy wheelchair access.

Seat Material: Phenolic or polymeric composite of either slat type or one-piece construction. Color as selected from manufacturer's standard selections.

2.2.3 Grab Bar (GB)

Grab bar shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type IV, Class 2, 32 mm OD stainless steel. Grab bar shall be form and length as indicated. Concealed mounting flange shall have set screw mounting holes concealed on the lip of the flange. Grab bar shall have a smooth finish. Installed bars shall be capable of withstanding a 2.225 kN vertical load without coming loose from the fastenings and without obvious permanent deformation. Bars shall be Bobrick 5806 Series or approved equal.

2.2.4 Medicine Cabinet (MC)

Medicine cabinet shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type III. Cabinets shall be Bobrick Model B-398 or approved equal.

2.2.4.1 Swinging Door Medicine Cabinet, Class 2

Swinging 3 door cabinet assembly shall be as indicated. Assembly shall be recess mounted. Mirror shall be provided on cabinet door with stainless steel frame at top and bottom. Door hinges shall be stainless steel or carbon steel. Magnets used in door catches shall be permanent type. BASLO model number S3636 FR-W or approved equal.

2.2.5 Mirror, Glass (MG)

Glass mirror shall conform to FS DD-M-411, Class 2, Style E. Mirror shall be Bobrick Model B-290 or approved equal. Size shall be as indicated on drawings.

2.2.6 Mirror, Tilt (MT)

Tilt mirror shall conform to FS DD-M-411, Class 2, Style E (Type 304 stainless steel) surface mounted and shall provide full visibility for person in a wheelchair. Mirror shall have fixed tilt, extending at least 100 mm from the wall at the top and tapering to 25 mm at the bottom. Size shall be 457 mm x 762 mm. Mirror shall be Bobrick Model B-293 or approved equal.

2.2.7 Mop and Broom Holder (MBH)

1.27 mm, Type 304, stainless steel hat channel with spring-loaded, rubber, cam-type mop/broom holders. Provide unit 900 mm and complete with four holders. Mop and broom holder shall be Bobrick Model B-239 or approved equal.

2.2.8 Paper Towel Dispenser (PTD)

Paper towel dispenser shall conform to CID A-A-2380, shall be constructed of not less than 0.85 mm carbon steel Type 304 stainless steel, and shall be surface mounted. Dispenser shall have a towel compartment with continuous piano hinge. Locking mechanism shall be tumbler key lock. Paper towel dispenser shall be Bobrick Model B-262 or approved equal.

2.2.9 Paper Towel Dispenser (PTD/SD)

Paper towel dispenser shall conform to CID A-A-2380, shall be constructed of not less than 0.85 mm carbon steel Type 304 stainless steel, and shall be surface mounted and shall dispense C-fold, single fold, or quarter fold towels. Dispenser shall have a towel compartment and a mirror door with continuous piano hinge, liquid soap dispenser and shelf. Locking mechanism shall be tumbler key lock. Paper towel dispenser shall be Bobrick Model B-3309 or approved equal.

2.2.10 Combination Paper Towel Dispenser/Waste Receptacle Units (PTD/WR-R)

Dispenser/receptacle shall be recessed and shall have a capacity of 400 sheets of C-fold, 700 single-fold, or quarter-fold towel. Waste receptacle shall be designed to be locked in unit and removable for service. Locking mechanism shall be tumbler key lock. Waste receptacle shall have a capacity of 45 L. Unit shall be fabricated of not less than 0.8 mm stainless steel welded construction with all exposed surfaces having a satin finish. Waste receptacle that

accepts reusable liner standard for unit manufacturer shall be provided. Paper towel dispenser shall be Bobrick Model B-3944 or approved equal.

2.2.11 Combination Paper Towel Dispenser/Waste Receptacle Units (PTD/WR-S)

Dispenser/receptacle shall be surface mounted and shall have a capacity of 400 sheets of C-fold, 700 single-fold, or quarter-fold towel. Waste receptacle shall be designed to be locked in unit and removable for service. Locking mechanism shall be tumbler key lock. Waste receptacle shall have a capacity of 45 L. Unit shall be fabricated of not less than 0.8 mm stainless steel welded construction with all exposed surfaces having a satin finish. Waste receptacle that accepts reusable liner standard for unit manufacturer shall be provided. Paper towel dispenser shall be Bobrick Model B-3949 or approved equal.

2.2.12 Robe Hook (RH)

Unit shall be Bobrick Model B-671 or approved equal.

2.2.13 Shower Curtain (SC)

Shower curtain shall conform to CID A-A-2398, Style I, size to suit conditions. Shower curtain and shower curtain hooks shall be Bobrick Model B-204 or approved equal.

2.2.14 Shower Curtain Rods (SCR)

Shower curtain rods shall be Type 304 stainless steel 32 mm (1-1/4 inch) OD by 1.24 mm (0.049 inch) thickness minimum straight to meet installation conditions. Shower curtains rods shall be Bobrick Model B-6107 or approved equal.

2.2.15 Soap Dispenser (SD)

Soap dispenser shall be lavatory mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 1.2 L (32 fluid ounces). Unit shall be Bobrick Model B-8221 or approved equal.

2.2.16 Soap and Grab Bar Combination, Recessed (SGR)

Soap and grab bar combination shall conform to FS WW-P-541/GEN or FS WW-P-541/8, Type IV, Class 3, Type 304 stainless steel, except unit shall be recessed type. Soap and grab bar shall be Bobrick Model B-4390 or approved equal.

2.2.17 Soap Holder (SH)

Soap holder shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type VI, Class 1, surface mounted, Type 304 stainless. Separate supports shall be stainless steel. Soap holder shall be Bobrick Model B-155 or approved equal.

2.2.18 Sanitary Napkin and Tampon Disposer (SND)

Sanitary napkin and tampon disposal shall be constructed of Type 304 stainless steel disposable liner type and shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type I, Class 1, Style P (partition mounted). Fifty disposable liners of the type standard with the manufacturer shall be provided. Sanitary napkin and tampon dispenser shall be Bobrick Model B-254 or approved equal.

2.2.19 Recessed Toilet-Seat-Cover Dispenser, Sanitary Napkin Disposal and Toilet Tissue Dispenser (SNT); Surface Mounted (SNT-S)

Combination recessed unit shall conform to FS WW-P-541/GEN and FS WW-P-541/8. Unit shall be Type 304 stainless steel and shall be fabricated of not less than 0.8 mm stainless steel welded construction with all exposed surfaces having a satin finish. Locking mechanism shall be tumbler key lock. Toilet seat cover dispenser shall hold 1000 single covers and have a piano hinge. Sanitary napkin disposal shall have a self-closing door full length piano hinge. Toilet tissue dispenser shall have two chrome plated plastic spindles. Dispenser unit shall be Bobrick Model B-3574 (for recessed wall), B-3571 (for dual partition use) or B-3579 (for surface mounted) or approved equal.

2.2.20 Sanitary Napkin and Tampon Dispenser (SNTD) with Door

Sanitary napkin and tampon dispenser shall conform to FS WW-P-541/GENand FS WW-P-541/8, Type I, Class 5, surface mounted. Dispenser, including door shall be Type 304 stainless steel and shall have a capacity of 31 napkins and 22 tampons. Dispensing mechanism shall be for complimentary operation. Sanitary napkin and tampon dispenser with door shall be Bobrick Model B-2800 or approved equal.

2.2.21 Recessed Toilet-Seat-Cover Dispenser and Toilet Tissue Dispenser (STT); Surface Mounted (STT-S)

Combination recessed unit shall conform to FS WW-P-541/GEN and FS WW-P-541/8. Unit shall be Type 304 stainless steel and shall be fabricated of not less than 0.8 mm stainles steel welded construction with all exposed surfaces having a satin finish. Locking mechanism shall be tumbler key lock. Toilet seat cover dispenser shall hold 1000 single covers and have a piano hinge. Toilet tissue dispenser shall have two chrome plated plastic spindles. Dispenser unit shall be Bobrick Model B-3474 (for recessed wall), B-3571 (dual partition use), B-3479 (surface mounted) or approved equal.

2.2.22 Towel Bar (TB)

Towel bar shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type IV, Class 1, stainless steel. Bar shall be minimum 19 mm (3/4 inch) diameter. Towel bar shall be Bobrick Model B-674 or approved equal.

2.2.23 Towel Bar, Ceramic (TBC)

Ceramic tile accessory. See specification 09310, Ceramic Tile.

2.2.24 Towel Pin (TP)

Towel pin shall have concealed wall fastenings, and a pin integral with or permanently fastened to wall flange. Maximum projection shall be 100 mm (4 inches). Design shall be consistent with design of other accessory items. Towel pin shall be Bobrick Model B-677 or approved equal.

2.2.25 Toilet Tissue Dispenser (TTD-R)

Toilet tissue holder shall be recess mounted with single roll of tissue mounted horizontally. Toilet tissue dispenser shall be Bobrick Model B-667 or approved equal.

2.2.26 Toilet Tissue Dispenser (TTD-S)

Toilet tissue holder shall be surface mounted with single roll of tissue mounted horizontally. Toilet tissue dispenser shall be Bobrick Model B-273 or approved equal.

2.2.27 Toothbrush and Tumbler Holder (TTH)
Toothbrush and tumbler holder shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type VI, Class 4, stainless steel, surface mounted. Toothbrush holder shall be Bobrick Model B-679 or approved equal.

2.2.28 Waste Receptacle (WR)

Waste receptacle shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type II, Type 304 stainless steel, designed for recessed mounting. Reuseable liner, of the type standard with the receptacle manufacturer, shall be provided. Capacity shall be not less than 12 gallons. Locking mechanism shall be push button or twist-type lock. Unit shall be Bobrick Model B-3644 or approved equal.

2.2.29 Coat Hook/Bumper (CH/B)
Coat hook bumper shall be stainless steel, surface mounted Bobrick Model B-212 or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet accessories shall be securely fastened to the supporting construction in accordance with the manufacturer's approved instructions. Accessories shall be protected from damage from the time of installation until acceptance.

3.2 SCHEDULE

Accessories Required
Barracks - Building #7039

Room or Space	CH/ B	GB	MBH	MC	SD MG	MT	PTD	PTD/ SD	PTD/ WR-R	PTD/ WR-S	RH	SC/ SCR	SD	SGR	SH	SNT	STT	TB	TTD R	TTH	TBC
Soldier Community Building - 7039																					
13			1					1													
14	1	2				1			1				1			1					
15	1	2				1			1				1					1			
Barracks - Building #7039																					
100-155 Foyer					1														1		
Lavatory				1															2		2
Bath											1	1		1	1					2	1	1
200- 255 Foyer					1													1			
Lavatory				1														2		2	
Bath											1	1		1	1			2	1		1
300-355 Foyer					1														1		
Lavatory				1														2		2	
Bath											1	1		1	1			2	1		1
J1 thru J13			1						1												

Accessories Required
Company Operations - Building #7075

Room or Space	CH/B	MBH	PTD	PTD/WR-R	SC/SCR	SD	SGR	SNT	STT	TP
153	4		1	1	12	4	12		2	12
155		1								
156	4		1	1	10	4	10	2		10
162	4		1	1	10	4	10	2		10
163		1								
165	4		1	1	12	4	12		2	12

Accessories Required
Battalion Headquarters - Buildings (7076, 7077,7081, and 7084)

Room or Space	GB	MBH	MG	PTD/WR-S	SC/SCR	SD	SGR	SND	STT	TP	TTD-S	CH/B	MT	STT-R	STT-S
116			1	1	1	1	1			2	1				
122			1	1		1					1				
133	2		3	2	6	4	3		11			2	1	1	1
144		1													
145	2		1	2	6	2	3	1	11			3	1	1	

Accessories Required
Brigade Headquarters - Building 7078

Room or Space	GB	MBH	MG	PTD/WR-S	SC/SCR	SD	SGR	SND	SNT	TP	TTD-S	STT	CH/B	MT	STT-R	SNT-R
117			1	1	1	1	1			2	1					
123			1	1				1				1				
140		1														
141	2		3	2	6	4		3			11		1	3	1	1
142	2		3	2	6	4	3		1	11			3	1		1

Accessories Required
Dining Facility - Building 7048

Room or Space	CH/B	GB	MG	MT	MBH	PTD	SD	SNT	STT	WR
107					1					
109	2	2	1	1	1	2	2	2		1
110	1	2	1	1	1	2	2			1
134	3		2			2	2	2		1
135	2		2			2	2			1
141	3	2	1	1	1	2	2	2		1
142	2	2	1	1	1	2	2			1
143					1					

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 10800
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO.	TRANS-MITTAL NO.	ITEM NO.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER	REV-IEW-ER	SUBMIT	APPROV. NEEDED BY	MATER. NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
a.	b.	c.	d. through q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
			PAR. NO. SD-01 Data										
		1	Finishes; GA.										
		2	Accessory Items; GA.										

***** SAFETY PAYS *****

SECTION 11132

PROJECTION SCREENS

PART 1 GENERAL 11132-1
1.1 REFERENCES 11132-1
1.2 SUBMITTALS 11132-1
1.3 QUALITY ASSURANCE 11132-1
1.4 DELIVERY, STORAGE, AND HANDLING 11132-1

PART 2 PRODUCTS 11132-2
2.1 PROJECTION SCREEN SURFACES, GENERAL 11132-2
2.2 CONCEALED AUTOMATIC ELECTRIC PROJECTION SCREENS 11132-2

PART 3 EXECUTION 11132-2
3.1 INSTALLATION 11132-2
3.2 PROTECTION AND CLEANING 11132-2
--END OF SECTION-- 11132-2

SECTION 11132

PROJECTION SCREENS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

FEDERAL STANDARDS (FS)

FS GG-S-00172 Screen, Projection

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Catalog Data; FIO.

Manufacturer's descriptive data and installation instructions shall be submitted for approval.

SD-04 Drawings

Detail Drawings; GA.

Detail drawings shall be submitted for approval. A schedule showing the location of each projection screen shall be submitted with the detail drawings. Drawings shall include elevations of each screen and shall show dimensions, details, and methods of mounting or anchoring, shape and thickness of materials, and details.

1.3 QUALITY ASSURANCE

1.3.1 Single Source Responsibility

Obtain each type projection screen required from a single manufacturer as a complete unit, including necessary mounting hardware and accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Do not deliver projection screens until building is enclosed, other construction within spaces where screens will be installed is substantially complete, and installation of screens is ready to take place.

1.4.2 Protect screens from damage during delivery, handling, storage, and installation.

1.4.3 Store projection screens in manufacturer's protective packages in a position that complies with screen manufacturer's directions. Keep units in manufacturer's protective packages until time of installation.

1.4.4 Protect surfaces of projection screens from damage due to abrasion, dust, and other conditions.

PART 2 PRODUCTS

2.1 PROJECTION SCREEN SURFACES, GENERAL

2.1.1 Measurement of Gain of Screen Viewing Surface

Measure gain of screen viewing surface against that of a magnesium carbonate surface by means of a photogoniometer using test methods and test apparatus per FS GG-S-00172 for determining effect of reflected light at various viewing angles on screen surfaces. Ratings of 1.0 refer to those viewing surfaces having a reflectivity equal to the magnesium carbonate surface.

2.2 CONCEALED AUTOMATIC ELECTRIC PROJECTION SCREENS

2.2.1 Screen Fabric

Screen fabric to be flame retardant and mildew resistant fiberglass with matte surface and black masking border.

2.2.2 Casing

Casing to be constructed of wood with metal-lined wiring compartment and hinged automatic bottom door for passge of screen. Casing to be finished with a primer coat.

2.2.3 Motor

Motor shall be 120V 60 Hz 1.3 amp electric motor with automatic thermal overload protection. Motor will be mounted inside rolle. Operation shall be by low voltage dual remote control system - 3 button rated at 120V 20 AMPS.

2.2.4 Size of Viewing Surface

Screen size to be 1800 mm x 2400 mm.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 General

Install projection screens at locations indicated to comply with screen manufacturer's written instructions. Install concealed overhead projection screen to partition at reinforced locations with approved fasteners.

3.2 PROTECTION AND CLEANING

3.2.1 Protection

Protect projection screens after installation from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION DISCOM Barracks Complex Phase 1, Fort Campbell, KY				CONTRACTOR										SPEC. SECTION 11132
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Manufacturer's Catalog Data; FIO.										
			SD-04 Drawings										
		2	Detail Drawings; GA.										

***** SAFETY PAYS *****

SECTION 11165

LOADING DOCK EQUIPMENT
6/98

PART 1 GENERAL....11165-1
1.1 REFERENCES....11165-1
1.2 GENERAL REQUIREMENTS....11165-1
1.3 SUBMITTALS....11165-1
1.4 DELIVERY AND STORAGE....11165-2

PART 2 PRODUCTS....11165-2
2.1 MATERIALS....11165-2
2.2 DOCK LEVELER OPERATION....11165-4
2.3 CORROSION PROTECTION AND PAINTING....11165-4

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3.2 INSPECTION....11165-5
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***** SAFETY PAYS *****

SECTION 11165

LOADING DOCK EQUIPMENT
6/98

PART 1 GENERAL

1.1 REFERENCES
The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

American Society for Testing and Materials (ASTM)

ASTM A 123 (1984) Specifications for Zinc (Hot-Dip Galvanized) on Iron and Steel Hardware.

ASTM A 153 (1982) Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

1.2.2 Nameplates

As a minimum, each loading dock leveler shall have the manufacturer's name, address, type or style, model or serial number, rated capacity, and catalog number on a plate secured to the equipment.

1.2.3 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Loading Dock Levelers; FIO.

Dock Bumpers; FIO.

Data shall include a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions.

SD-04 Drawings

Loading Dock Levelers; FIO.

Dock Bumpers; FIO.

Drawings shall show sizes, dimensions and finish, installation details. Drawings shall contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detail drawings shall show proposed layout and anchorage of equipment and appurtenances. Detail drawings shall show the concrete pit details including flush edge angles, dock bumpers, sloped pit bottom and dock shelters; method of mounting and anchoring; and location of control stations and disconnect switches. For vertical, edge-of-dock, and free-standing board dock levelers, drawings shall show details of required building construction and dock bumpers and structural shapes installation, in lieu of concrete pit details.

SD-06 Instructions

Loading Dock Levelers; FIO.

Dock Bumpers; FIO.

Manufacturer's specifications and installation instructions.

SD-19 Operation and Maintenance Manuals

Loading Dock Levelers; FIO.

Six copies of operation and six copies of maintenance manuals shall be provided for the equipment furnished. One complete set shall be furnished prior to performance testing and the remainder shall be furnished upon acceptance. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed. After approval of the detail drawings, and not later than two months prior to the date of beneficial occupancy, spare parts data for each different item of material and equipment specified are required. The data shall include a complete list of parts and supplies, with current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 and 3 year(s) of service.

1.4 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Loading Dock Levelers

Loading dock levelers shall be permanent type, and shall have minimum dynamic loading capacity of 11,340 kg. When not in use and in the cross traffic position, loading dock leveler area shall be level with the surrounding loading area.

2.1.1.1 Type

Loading dock leveler shall be electrohydraulic type with electric motor and hydraulic pump operating a hydraulic cylinder that adjusts dock leveler board position. A truck restraint system shall be coordinated with the dock leveler to lock truck or trailer into position during loading and for overnight security. A visual signal shall be incorporated to inform dock operator and driver of locked or unlocked status.

2.1.1.2 Operating Range

The outer end of each loading dock leveler shall be adjustable in height, providing a board whose incline can be adjusted to suit the height of truck and trailer beds. Each board end shall have a minimum of 559 mm of vertical adjustment. Height adjustments shall be divided 305 mm above and 254 mm below the dock level to provide coverage between 1 524 mm and 965 mm above grade.

2.1.1.3 Lip Extension

Each loading dock leveler shall include provisions so that its end lip may be extended from a retracted position to an extended position beyond the forward edge of the platform bumpers to rest on the bed of a truck or trailer not less than 406 mm. Lip extension shall be 508 mm.

2.1.1.4 Tilt Allowance

Each loading dock leveler shall provide automatic compensation, with board loaded, for out-of-level truck bed condition (difference in elevation from side to side at the rear of the truck bed) of up to 102 mm over the width of the board.

2.1.1.5 Load Compensation

Each loading dock leveler shall be constructed to provide automatic compensation (automatic float), with board loaded or unloaded, for the loading and unloading of the motor vehicle. When the end lip is extended so as to rest on the bed of a truck or trailer, the end lip shall automatically adjust up or down with the movement of the truck or trailer bed resulting from the compression of the truck or trailer springs.

2.1.1.6 Automatic Safety Device

2.1.1.6.1 Mechanical

An automatic safety device shall be provided to prevent a drop of more than 102 mm at the outer end of the board should the truck or trailer be moved away leaving the board unsupported. This safety device shall be effective with any load on the board up to the fully dynamic rated capacity of the loading dock leveler.

2.1.1.6.2 Electrohydraulic

A hydraulic check valve shall be provided to prevent a drop of more than 76 mm at the outer end of the board should the truck or trailer be moved away leaving the board unsupported. This safety device shall be effective with any load on the board up to the fully dynamic rated capacity of the loading dock leveler.

2.1.1.7 Dimensions

The live load carrying surface of the leveler shall be nominal 2.15 meters wide and 2.11 meters long with end lip retracted.

2.1.1.8 Motor

Each electrohydraulic loading dock leveler shall be equipped with a totally enclosed fan cooled (TEFC) squirrel cage induction electric motor, three phase, 208 volts, 60 Hz, which shall not exceed its rated capacity under full load conditions of loading dock leveler.

2.1.1.9 Controls

Each electrohydraulic loading dock leveler shall be equipped with a power unit installed under the leveler proper as an integral part of the loading dock leveler. Each loading dock leveler shall be controlled by a heavy duty push button station located as shown with an "UP" or "RAISE" button. Dual controls, shall be provided. To prevent accidental operation and damage, each button shall be recessed in its station or protected by a projected peripheral collar. Station push button shall be indelibly identified by means of cast or etched letters on the station. Push button station shall be of rugged design and positive in operation; no less than NEMA Type 4 enclosure shall be furnished. Buttons shall be constant pressure type so that operation will cease immediately on release of button. Electrical work shall conform to Section 16415 ELECTRICAL WORK, INTERIOR.

2.1.2 Dock Bumpers

High-impact resistant molded or laminated rubber dock bumpers, thickness and size as indicated on drawings with angles as indicated on the drawings and 20mm tie rods, hot dip galvanized (ASTM A 123).

2.1.2.1 Anchor Bolts

20 mm, 25 mm long, hot-dip galvanized (ASTM A 153) "J" bolts.

2.1.2.2 Touch-Up Paint

Cold Galvanizing Compound, organic zinc paint, minimum 70% solids content.

2.2 DOCK LEVELER OPERATION

Continuous pressure on the operating button shall cause the outer end of the board to raise and thus permit the operator to adjust the board incline as required to suit the level of the bed of a particular truck or trailer. Control shall activate board automatically to raise to maximum height and lower to rest on truck or trailer bed. The operator may interrupt cycle to lower board to resting position when desired. End lip on board shall extend hydraulically, automatically during board operation or by separate control button on panel. Dock leveler shall automatically return to storage position when truck or trailer moves away. Operation shall also permit lowering of board below dock level without extending end lip.

2.3 CORROSION PROTECTION AND PAINTING

2.3.1 Fasteners

Bolts, screws, nuts, and washers shall be coated with hot-dip zinc or cadmium or made of corrosion resistant metal.

2.3.2 Ferrous Metal Surfaces

Ferrous metal surfaces, including coated ferrous and inaccessible ferrous surfaces, (but not including bearings, gear contact surfaces, parts protected by lubrication, or other surfaces not usually painted or coated) shall be cleaned, phosphate treated, and given coat of epoxy primer followed by coat of epoxy or other approved coatings. Total dry film thickness shall be not less than 0.254 mm (10 mils). Cleaning, phosphate treating, and painting or coating shall conform to FS TT-C-490. Coatings shall be allowed to dry hard before shipment. Color of finish coats shall be medium gray or manufacturer's standard.

2.3.3 Nonferrous Parts

Nonferrous parts shall be protected against corrosion as necessary.

2.3.4 Dissimilar Metals

Dissimilar metals which may be subject to electrolysis upon contact shall be separated by electrolytically inactive material.

PART 3 EXECUTION

3.1 INSTALLATION:

3.1.1 Dock Bumpers

Set all bolts accurately with proper clearance required. Dock bumpers shall be installed level, in true alignment, with top of bumper 24 mm below dock level. Dock bumpers shall be fastened by welding when attached to steel and with anchor bolts plug welded when attached to concrete. Welds and steel abrasions shall be given two coats of touch-up paint.

3.1.2 Dock Leveler

Installation shall be as indicated and in accordance with manufacturer's installation instructions. Loading dock leveler and accessories shall operate easily and perform reliably. Unsatisfactory operation shall result in correction adjustment, or reinstallation until satisfactory performance and operation is achieved and installation is acceptable to the Contracting Officer.

3.2 INSPECTION

Inspect areas and conditions under which the bumpers are to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION DISCOM Barracks Complex Phase 1, Fort Campbell, KY				CONTRACTOR									SPEC. SECTION 11165	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-01 Data										
		1	Loading Dock Levelers; FIO.										
		2	Dock Bumpers; FIO.										
			SD-04 Drawings										
		3	Loading Dock Levelers; FIO.										
		4	Dock Bumpers; FIO.										
			SD-06 Instructions										
		5	Loading Dock Levelers; FIO.										
		6	Dock Bumpers; FIO.										
			SD-19 Operation and Maintenance Manuals										
		7	Loading Dock Levelers; FIO.										

***** SAFETY PAYS *****

SECTION 11310

SEWAGE LIFT STATION

PART 1 GENERAL 11310-1
1.1 REFERENCES 11310-1
1.2 SUBMITTALS 11310-1
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SECTION 11310

SEWAGE LIFT STATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABEMA)

ABEMA Std 9	(1990) Load Ratings and Fatigue Life for Ball Bearings
ABEMA Std 11	(1990) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 153	1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(1993) Industrial Controls and Systems
NEMA MG 1	(1993; Rev 1; Rev 2) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996) National Electrical Code

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Sewage and Sludge Pump System; GA.

Pump characteristic curves showing capacity in gpm, net positive suction head (NPSH), head, efficiency, and pumping horsepower from 0 gpm to 110 percent of design capacity. A complete list of equipment and material, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions.

Spare Parts; FIO.

Spare parts data for each different item of material and equipment specified, after approval of the related submittals, and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Sewage and Sludge Pump System; GA.

Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-09 Reports

Field Testing and Adjusting Equipment; FIO.

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-19 Operation and Maintenance Manuals

Sewage and Sludge Pump System; GA.

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set prior to performance testing and the remainder upon acceptance. Operation manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed. Manuals shall be approved prior to the field training course.

1.3 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

1.4 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.1 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.1.2 Equipment Guards

Belts, pulleys, chains, gears, projecting setscrews, keys, and other rotating parts so located that any person may come in close proximity thereto shall be enclosed or guarded.

2.1.3 Special Tools

One set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment shall be provided.

2.1.4 Electric Motors

Motors shall conform to NEMA MG 1.

2.1.5 Motor Controls

Controls shall conform to NEMA ICS 1.

2.1.6 Bolts, Nuts, Anchors, and Washers

Bolts, nuts, anchors, and washers shall be steel; galvanized in accordance with ASTM A 153.

2.2 SUBMERSIBLE CENTRIFUGAL PUMPS

Submersible centrifugal pumps shall be centrifugal type pumps designed to pump solids up to 76.2 mm (3 inches) in diameter and shall be capable of withstanding submergence as required for the particular installation. The pumps shall be Gorman-Rupp J-Series submersible pumps or approved equal.

2.2.1 Pump Characteristics

Pumps shall have the following operating characteristics:

a. Pump Service: Sewage Lift Station, Duplex Pump System.

b. Design Operating Point: 11 liters per second (175 gpm) flow, 20422mm (67 feet) head, 40 percent efficiency.

c. Maximum Operating Point: 38 liters per second (600 gpm) flow, 13411 mm (44 feet) head, 58 percent efficiency.

d. Minimum Operating Point: 6.3 liters per second (100 gpm) flow, 22250 mm (73 feet) head, 27 percent efficiency.

e. Impeller Type: Cast Iron.

f. Operating Speed: 1750 rpm.

g. Depth of Submergence: 0.46 mm (1.5 feet).

h. Motor Type: Dry shell, induction squirrel cage; 13 HP.

i. Electrical Characteristics: 230 volts ac, 3 phase, 60 Hz.

j. Size: Within rated load driving pump at specified rpm.

k. Pump Control: Lead-lag with alternating lead; pump on/off by float switches.

2.2.2 Pump Casing

The casing shall be of gray iron with a gray iron or ductile iron slide rail guide shoe attached to the discharge flange as an integral assembly. Casing shall be easily removable from the motor for full inspection of the impeller.

2.2.3 Mating Surfaces

Mating surfaces where watertight seal is required, including seal between discharge connection elbow and pump, shall be machined and fitted with nitrile rubber O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between mating surfaces, resulting in proper compression of the O-rings without the requirement of specific torque limits.

2.2.4 Coatings

Exterior surfaces of the casing in contact with sewage shall be protected by a sewage resistant coal tar epoxy coating. All exposed nuts and bolts shall be stainless steel.

2.2.5 Impeller

2.2.5.1 The impeller shall be of semi-axial flow design incorporating one or two long sweeping vanes with wide flow channels to minimize clogging of solids, fibrous materials, heavy sludge, or other materials found in sewage. Impeller shall be trimmed as required to meet design conditions. The impeller shall be gray iron or ductile iron with designed counterweight mass for dynamic balancing to eliminate vibration. Balancing shall not deform or weaken the impeller. The impeller shall be securely keyed to the shaft with a locking arrangement whereby the impeller cannot be loosened by torque from either forward or reverse direction. Impeller fasteners shall be non-clogging.

2.2.5.2 The back of the impeller shall incorporate straight auxiliary vanes to hydraulically reduce pressure on the primary seal, and force debris away from the impeller clearance. No wear rings or adjustment of the backside clearance will be required.

2.2.5.3 The suction clearance between the impeller and pump casing shall be in the axial direction only. This clearance must be fully adjustable to maintain peak operating efficiency of the pump. The adjustment shall be easily accomplished using external adjusting screws.

2.2.6 Wearing Rings

Wearing rings, when required, shall be renewable type and shall be provided on the impeller and casing and shall have wearing surfaces normal to the axis of rotation. Material for wear rings shall be standard of pump manufacturer. Wearing rings shall be designed for ease of maintenance and shall be adequately secured to prevent rotation.

2.2.7 Pump Shaft

The pump shaft shall be of AISI Type 329 stainless steel or high grade alloy steel with protective stainless steel shaft sleeve which prevents contact of the shaft with liquid. The shaft shall be machined with shoulders or snap ring grooves for positive placement of bearings.

2.2.8 Shaft Seal

2.2.8.1 On pump applications above 13 hp, 2 separate mechanical seals shall be provided, arranged in tandem. The upper seal shall have a hardened stainless steel rotating face and carbon stationary face. The lower seal shall incorporate silicon carbide on both the rotating and stationary faces. Cage and springs shall be of stainless steel and elastomers of viton.

2.2.8.2 Each silicon carbide or stainless steel seal face shall be lapped to a flatness tolerance not to exceed one-half light band or 5.8 millionths of an inch, as measured by an optical flat and monochromatic light. The rotating faces must be of double floating and self-aligning design to insure full face contact at all times, even during periods of shock loads that will cause deflection, vibration and axial or radial movement of the pump shaft.

2.2.8.3 The rotating seal faces shall be lubricated from an oil filled reservoir between pump and motor; the oil serving as both lubricating and cooling media. The reservoir shall have separate oil fill and drain plugs to insure accuracy when measuring lubricant level and for ease of maintenance.

2.2.8.4 Seal shall require no special maintenance or routine adjustment; however, shall be easily inspected or replaced. No seal damage shall result from operating the pump for short periods of time without liquid.

2.3 INSTALLATION SYSTEM

2.3.1 Automatic Discharge Connection

Each pump shall be furnished with a submersible discharge connection system to permit removal and installation of the pump without the necessity of an operator entering the wetwell. The design must insure an automatic and firm connection of the pump to the discharge piping when lowered into place.

2.3.2 Baseplate

A gray iron or fabricated steel base plate with integral guide rail pilots shall be provided along with all hardware and anchor bolts required for permanent installation to the wetwell floor for each pump. The baseplate shall be designed with an integral 90 degree elbow. The baseplate shall be coated with coal tar epoxy for corrosion resistance. The manufacturer shall provide all necessary drawings to insure proper installation and alignment of baseplate within the sump.

2.3.3 Discharge Connection

Each pump shall be provided with a replaceable ductile iron slide rail guide shoe attached to the pump discharge flange. A replaceable neoprene seal shall be provided as an integral part of the guide shoe to form a seal with the baseplate connection and eliminate the possibility of leakage and erosion wear during operation. The seal shall contact mating faces in a static position and shall have adequate flexibility to flex under pumping pressure to increase seal efficiency. Metal-to-metal contact at the discharge connection shall not be acceptable. The pump supplier shall provide 2 lengths of 2 inch stainless steel guide rail pipe for each pump of the length required based on the Drawings and manufacturer’s recommendations. Upper guide rail pilots and a lifting chain shall be furnished for each pump. Bottom pilots shall be an integral part of the baseplate for ease of installation and proper alignment.

2.3.4 Guide Rail System

The guide shoe shall direct the pump down 2 vertical guide rails and onto the discharge connection in a single lineal movement. The buildup of sludge and grease on guide rails shall not present problems during the lifting operation. The guide shoe shall be designed with integral hookd at the top to transmit full weight of the pump to the base plate flange. No portion of the pump shall be supported directly on the bottom of the wetwell, guide rails, or lifting cable.

2.3.5 Lifting Chain

The lifting chain shall consist of a single stainless steel braided wire cable attached to the pump lifting bail. An eyelet shall be provided at the upper end of this cable for attaching to the wet well access frame.

2.4 PUMP MOTOR

2.4.1 Electrical Power Available

The electrical power to be furnished to this site shall be as shown on the electrical drawings.

2.4.2 Motor Description

a. The submersible pump motor shall operate in accordance with the electrical power indicated above. The motor and pump must be connected to form an integral unit. Motor shall be a squirrel-cage, induction type in an air-filled watertight enclosure. The motor shall conform to NEMA design Class B, and incorporate Class F insulation materials to withstand a continuous operating temperature of 155 degrees C (311 degrees F). The pump and motor shall be capable of handling liquids with a maximum temperature of 40 degrees C (104 degrees F).

b. Motor shall be capable of sustaining a minimum of 10 starts per hour. The motor shall operate while only partially submerged and not require a cooling jacket or any other means of auxiliary cooling during normal continuous operation.

c. Motor housing shall be of cast iron. The stator shall consist of copper windings with copper connectors applied to high grade electrical steel laminations. The stator shall be held securely in place by a heat-shrink fit into the motor housing. Any other means of securing the stator which would require penetrations of the motor housing shall not be considered acceptable.

d. Rotor shall be solid cast and dynamically balanced for vibration-free operation. Rotor end bars and short circuit rings shall be of aluminum. The pump shaft shall be of AISI Type 329 stainless steel (or hardened alloy steel with protective stainless steel shaft sleeve which prevents contact of the shaft with the liquid). The shaft shall be machined with shoulders or snap ring grooves for positive placement of bearings. The upper and lower bearing shall be of heavy duty design, capable of supporting the shaft and rotor while under maximum radial and thrust loads. The bearings shall be permanently grease lubricated and sealed at the time of installation.

2.4.3 Watertight Integrity

2.4.3.1 Pump and Electrical Cables

The pump and electrical cables shall be capable of continuous submergence without loss of waterproof integrity to a depth of 65 feet.

2.4.3.2 Motor Housing and Shaft Seal

The watertight integrity of the motor housing and shaft seal shall be tested during manufacture by pressuring the motor cavity and submerging in water with motor operating.

2.4.3.3 Motor Protection

The motor shall be protected from thermal and moisture damage. Thermal protection shall consist of 3 separate thermostatic switches embedded into the stator windings. Each switch shall open independently and terminate motor operation if temperature of the protected winding reaches the high temperature set point. Any moisture in the motor housing shall be detected by a mechanically activated moisture-sensing micro-switch. The switch shall be sensitive enough to detect air-borne moisture and terminate operation of motor before liquid enters the cavity. The thermal and moisture sensing devices shall be connected to the pump control panel by the Contractor.

2.5 ELECTRICAL CONTROL COMPONENTS

2.5.1 Controls

The pump control panel shall be manufactured by a UL panel builder and the assembly shall bear a serialized UL label for “Enclosed Industrial Control Panels”. Lighting for open style industrial control panels or an assembly of listed or recognized components shall not be acceptable. The control panel shall be supplied by the pump supplier and come prewired.

2.5.2 Panel Enclosure

The electrical control equipment shall be mounted within a NEMA 12 steel, dead front type control enclosure. The enclosure door shall be hinged and sealed with a neoprene gasket. It shall include a removable steel back panel on which control components shall be mounted. Operator controls shall be mounted on a steel inner swing panel. The enclosure shall be mounted in the adjacent building as indicated on the drawings. The control panel shall be equipped with vapor emission type corrosion inhibitors.

2.5.3 Mounting

All motor branch circuits shall be of the highest industrial quality, securely fastened to a removable sub-plate with screws and lockwashers. The sub-plate shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component. All operating controls and instruments shall be securely mounted and shall be clearly labeled to indicate function.

2.6 MOTOR BRANCH COMPONENTS

2.6.1 Main Connections

A main terminal block and ground bar shall be furnished for field connection of the electrical supply. The connections shall be designed to accept copper conductors of sufficient size to serve the pump station loads. The main terminal block shall be mounted to allow incoming wire bending space in accordance with Article 373 of the National Electrical Code (NEC).

2.6.2 Circuit Breakers and Operating Mechanisms

A properly sized heavy duty air circuit breaker shall be furnished for each pump motor, and shall have a symmetrical RMS interrupting rating of 14,000 amperes at 460 volts. All circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering. A padlocking operating mechanism shall be installed on

each motor circuit breaker. Operator handles for the mechanisms shall be located on the inner door, with interlocks which permit the inner door to be opened only when circuit breakers are in the “OFF” position.

2.6.3 Motor Starters

An open flame, across-the-line, NEMA rated magnetic motor starter shall be furnished for each pump motor. Starters of NEMA Size 1 and above shall be designed for addition of at least 2 auxiliary contacts. Starters rated “0”, “00”, or fractional size shall be double-break and made of cadmium oxide silver. Coils shall be epoxy molded for protection from moisture and corrosive atmospheres. The starter assembly shall be equipped with a metal mounting plate for durability. All motor starters shall be equipped to provide under-voltage release and overload protection on all 3 phases. Motor starter contacts and coils shall be easily replaceable without removing the motor starter from its mounted position.

2.6.4 Overload Relays

Overload relays shall be of block-type, utilizing melting alloy type spindles, and shall have visual trip indication with trip free operation. Pressing the overload reset lever shall not actuate the control contact until such time as the overload spindle has reset. Resetting of the overload reset lever will cause a snap-action control contact to reset, thus reestablishing a control circuit. Overload relays shall be of manual reset only and not convertible to automatic reset. Trip settings shall be determined by the heater element only and not by adjustable settings. Heater elements shall provide NEMA Class 10 trip times and shall be selected in accordance with the actual motor nameplate data. An overload reset pushbutton shall be mounted through the door of the control panel in such a manner as to permit resetting the overload relays without opening the control panel door.

2.6.5 Pump Motor Protection

The pump control panel shall be equipped to terminate pump operation due to high motor winding temperature or moisture in the motor housing and shall utilize the contacts in the pump motor. If either event should occur, the motor starter will drop out and a mechanical indicator, visible on the inner door, shall indicate the pump motor has been shutdown. The pump motor shall automatically reset when the condition has been corrected. However, the mechanical indicator shall require manual reset.

2.6.6 Phase Monitor

The control panel shall be equipped to monitor the incoming power and shut down the pump when required to protect the motor(s) from damage caused by phase reversal, phase loss, voltage unbalance greater than 5 percent or voltage less than 83 percent on nominal. A time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart when power conditions return to normal.

2.6.7 Secondary Surge Arrester

The control panel shall be equipped with a surge arrester to minimize damage to the pump motors and control from transient voltage surges. The arrester shall utilize metal-oxide varistors encapsulated in a non-conductive housing. The arrester shall be rated 480 volts RMS nominal with a discharge capability of 2000 amps.

2.6.8 Dry Contacts

The control panel manufacturer shall supply a minimum of 12 dry contacts wired to terminal blocks for field connection to a future remote status/telemetry indication system.

2.7 OTHER CONTROL COMPONENTS

2.7.1 Control Circuit

The control circuit shall be protected by a normal duty thermal-magnetic air circuit breaker which shall be connected in such a manner as to allow control power to be disconnected from all control circuits.

2.7.2 Pump Mode Selection

Pump mode selector switches shall be connected to permit manual start and manual stop for each pump individually, and to select automatic operation of each pump under control of the liquid level control system. Manual operation shall override the liquid level control system. Selector switches shall be heavy duty, oil-tight design, with contacts rated NEMA A300 minimum.

2.7.3 Alternator Relay

Pump alternator relay contacts shall operate after pump shutdown. Relay contact shall be rated 10 amperes minimum at 120 volts non-inductive.

2.7.4 Pump Run Indicators

Control panel shall be equipped with one oil-tight pilot light for each pump motor. Light shall be wired in parallel with the related pump motor starter to indicate that the motor is on or should be running. Run lights shall be equipped with lamps providing a minimum of 15,000 hours.

2.7.5 Elapsed Time Indicators

Six digit elapsed time indicators (non-reset type) shall be connected to each motor starter to indicate the total running time of each pump in “hours” and “tenth of hours”.

2.7.6 Sequence Selector Switch

A switch shall be provided to permit the station operator to select automatic alternation of the pumps, to select pump number one to be the lead pump for each pumping cycle, or to select pump number two to be the lead pump for each pumping cycle. Selector switch shall be heavy duty, oil-tight design, with contacts rated NEMA A300 minimum.

2.7.7 Receptacle

A duplex ground fault indicating utility receptacle providing 115 VAC, 60 Hertz, single phase current, shall be mounted through the inner swing panel of the control enclosure. Receptacle circuit shall be protected by a 15 ampere thermal-magnetic circuit breaker.

2.7.8 Auxiliary Power Transformer

The lift station shall be equipped with a 3 KVA stepdown transformer to supply 115 volt, AC, single phase for the control and auxiliary. The primary side of the transformer shall be protected by a thermal magnetic air circuit breaker, specifically sized to meet the power requirements of the transformer. A mechanical operating mechanism shall be installed on the circuit breaker to provide a means of disconnecting power to the transformer. The operator handle for the mechanism shall be located on the exterior of the control panel, with interlocks which permit the door to be opened only when the circuit breaker is in the “OFF” position.

2.8 WIRING

The control panel, as furnished by the supplier, shall be completely wired. The Contractor shall field connect the power feeder lines to the main terminal block, final connections to the remote alarm devices, and the connections between the pump and the pump motor control. All wiring, workmanship, and schematic wiring diagrams shall be in compliance with applicable standards and specifications set forth by the National Electric Code (NEC).

All user serviceable wiring shall be Type MTW or THW, 600 volts, and shall be color coded as follows:

a. Line and Load Circuits, AC and DC Power: Black

b. AC Control Circuit Less Than Line Voltage: Red

c. DC Control Circuit: Blue

d. Interlock Control Circuit, From External Source: Yellow

e. Equipment Grounding Conductor: Green

f. Current Carrying Ground: White

g. Hot with Circuit Breaker - Open: Orange

2.8.1 Wire Identification and Sizing

a. Control circuit wiring inside the panel, with the exception of internal wiring of individual components, shall be of 16 gage minimum, Type MTW or THW, 600 volts. Power wiring shall be 14 gage minimum.

b. The ampacity of motor branch conductors and other power conductors shall not exceed the temperature rating of the connecting terminals. Wires shall be clearly numbered at each end in accordance with the electrical diagrams. All wires on the sub-plate shall be bundled and tied.

2.8.2 Wire Bundles

Wires connected to components mounted on the enclosure door shall be bundled and tied in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall be provided to allow the door to swing to its full open position without undue stress or abrasion on the wire or insulation. Bundles shall be held in place on each side of the hinge by mechanical fastening devices.

2.9 CONDUIT

2.9.1 Conduit requirements are as follows:

a. All conduit and fittings shall be UL listed.

b. Liquidtight flexible metal conduit shall be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquidtight, polyvinyl chloride cover.

c. Conduit shall be supported in accordance with Articles 346, 347, and 350 of the National Electrical Code.

d. Conduit shall be sized according to the National Electrical Code.

2.9.2 Grounding

a. The pump control manufacturer shall provide a common ground bar mounted on the enclosure back plate. The mounting surface of the ground bar shall have any paint removed before making final connections.

b. The Contractor shall make the field connections to the main ground lug and each pump motor in accordance with the National Electric Code.

2.9.3 Equipment Marking

a. A permanent corrosion resistant name plate shall be attached to the control and include the following information:

(1) Equipment serial number

(2) Supply voltage, phase, and frequency

(3) Current rating of the minimum main conductor

(4) Electrical wiring diagram number

(5) Motor horsepower and full load current

(6) Motor overload heater element

(7) Motor circuit breaker trip current rating

(8) Name and location of equipment manufacturer

b. Control components shall be permanently marked using the same identification shown on the electrical diagram. Identification label shall be mounted adjacent to the device.

c. Switches, indicators, and instruments shall be plainly marked to indicate function, position, etc. Marking shall be mounted adjacent to and above the device.

2.10 LIQUID LEVEL CONTROL

The liquid level controls shall be supplied by the same supplier as the pump.

2.10.1 Functional Description

The level control system shall start and stop the pump motors in response to changes in wet well level, as set forth herein.

2.10.2 Type

The level control system shall be the mercury switch float type, incorporating floats secured to a vertical pipe in the wet well. Rising and falling liquid level in the wet well causes switches within the floats to open and close, providing start and stop signals for the level control components.

2.10.3 Sequence of Operation

The level control system shall start one pump when the liquid level in the wet well rises to the “lead pump start level”. When the liquid is lowered to the “pump stop level”, the system shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level rise to the “lag pump start level”, the system shall start the second pump so that both pumps are operating to pump down the well. Both pumps shall stop and the same “stop” level.

2.10.4 Automatic Pump Alternation

The level control system shall utilize the alternator relay to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle.

2.11 SYSTEM COMPONENTS

2.11.1 Float Switches

Pump supplier shall furnish three float switch assemblies for installation by the Contractor. Each switch assembly shall contain a mercury-type switch sealed in a polypropylene housing, and not less than 20 feet of cable. Pump supplier shall also furnish polypropylene mounting hardware for switch assemblies. Sufficient length of non-corrosive pipe for mounting switch assemblies in the wet well shall be furnished by the installing contractor.

2.11.2 Circuit Design

Circuit design in which the application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit shall not be acceptable.

2.11.3 High Water Alarm

Pump supplier shall furnish a separate float switch assembly, and a magnetic switch for high water alarm function. Should the wet well level rise to the high water alarm level, the float switch assembly shall energize a magnetic switch. The magnetic switch shall complete a 115 volt AC circuit for an external alarm device. A mechanical indicator, visible on the front of the control panel door, shall indicate that a high wet well level exists. The magnetic switch shall maintain the alarm signal until the wet well level has been lowered and the circuit has been manually reset.

2.11.4 Alarm Silence

An alarm silence pushbutton and relay shall be provided to permit maintenance personnel to de-energize the audible alarm device while corrective actions are under way. After silencing the alarm device, manual reset of the alarm condition shall clear the alarm silence relay automatically. The pushbutton shall be heavy duty, oil tight design with contacts rated NEMA A300 minimum.

2.12 ALARM LIGHT (EXTERNAL)

The pump package shall be supplied with one 115 volt AC alarm light with red globe, conduit box, and mounting fixtures. The light shall be shipped loose for field mounting by the Contractor.

3 EXECUTION

3.1 EQUIPMENT INSTALLATION

3.1.1 Pump Installation

Pumping equipment and appurtenances shall be installed in the position indicated and in accordance with the manufacturer's written instructions. All appurtenances required for a complete and operating pumping system shall be provided, including such items as piping, conduit, valves, wall sleeves, wall pipes, concrete foundations, anchors, grouting, pumps, drivers, power supply, seal water units, and controls.

3.1.2 Concrete

Concrete shall conform to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.2 PAINTING

Pumps and motors shall be thoroughly cleaned, primed, and given two finish coats of paint at the factory in accordance with the recommendations of the manufacturer. Field painting required for ferrous surfaces not finished at the factory is specified in Section 09900 PAINTING, GENERAL.

3.3 FIELD TESTING AND ADJUSTING EQUIPMENT

3.3.1 Operational Test

Prior to acceptance, an operational test of all pumps, drivers, and control systems shall be performed to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; is in safe and satisfactory operating condition; and conforms with the specified operating characteristics. Prior to applying electrical power to any motor driven equipment, the drive train shall be rotated by hand to demonstrate free operation of all mechanical parts. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of control systems and equipment, proper alignment, excessive noise levels, and power consumption.

3.3.2 Retesting

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted.

3.4 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

3.5 NOT USED

3.6 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 4 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals.

***** SAFETY PAYS *****

--End of Section----

SUBMITTAL REGISTER (ER415-1-10)												CONTRACT NO.	
TITLE AND LOCATION				CONTRACTOR								SPEC. SECTION 11310	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Sewage and Sludge Pump System; GA.										
		2	Spare Parts; FIO.										
			SD-04 Drawings										
		3	Sewage and Sludge Pump System; GA.										
			SD-09 Reports										
		4	Field Testing and Adjusting Equipment; FIO.										
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***** SAFETY PAYS *****

ENG FORM 4288-R, (LRL), JAN 97 **EDITION OF MAR 95 IS OBSOLETE**

PAGE 1

SECTION 11400

FOOD SERVICE EQUIPMENT
03/89

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*** SAFETY PAYS ***

SECTION 11400

FOOD SERVICE EQUIPMENT
03/89

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH-01	(1992; 21st Ed) Industrial Ventilation - A Manual of Recommended Practices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1990) Structural Steel
ASTM A 53	(1990a) Pipe, Steel, Black and Hot-Dipped, Zinc -Coated Welded and Seamless
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 167	(1990) Stainless and Heat-Resisting Chromium -Nickel Steel Plate, Sheet, and Strip
ASTM A 240	(1993b) Heat-Resisting Chromium and Chromium -Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM B 43	(1991) Seamless Red Brass Pipe, Standard Sizes
ASTM B 75	(1986) Seamless Copper Tube
ASTM B 88	(1989) Seamless Copper Water Tube
ASTM D 520	(1984; R 1989) Zinc Dust Pigment

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.22	(1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes

FEDERAL SPECIFICATIONS (FS)

FF L-P-508	(Rev H; Notice 1) Plastic Sheet, Laminated, Decorative and Nondecorative
FS QQ-B-654	(Rev A; Am 1; Notice 1) Brazing Alloys, Silver

FS QQ-S-571	(Rev E; Am 5; Int Am 6) Solder, Electronic (96 to 485 Degrees C)
FS W-C-375/GEN	(Rev B; Notice 1) Circuit Breakers, Molded Case; Branch Circuit and Service
FS WW-P-460	(Rev C; Am 1; Notice 1) Pipe Fittings Brass or Bronze Threaded 125-Pound and 250-Pound
FS WW-P-541/GEN	(Rev E; Am 1) Plumbing Fixtures
FS WW-P-541/8	(Rev B; Am 1) Plumbing Fixtures (Accessories, Land Use)
FS WW-V-35	(Rev C) Valve, Ball

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1985; Rev 1 & 2, ICS 6) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 6	(1988; Rev 1) Enclosures for Industrial Control and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 17A	(1990) Wet Chemical Extinguishing Systems
NFPA 54	(1988) National Fuel Gas Code
NFPA 70	(1990) National Electrical Code
NFPA 96	(1991) Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment

NATIONAL SANITATION FOUNDATION (NSF)

NSF-01	(Oct 1990) NSF Listings - Food Service Equipment and Related Products, Components, and Materials
NSF-02	(Jul 1968; updated Feb 1989) Installation Manual for Food Service Equipment
NSF Std 2	(Oct 1952; Rev Nov 1987) Food Service Equipment
NSF Std 7	(1990) Food Service Refrigerators and Storage Freezers

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION

SMACNA	(1993) 5th edition; Sheet Metal and Air Conditioning ContractorsNational Association

UNDERWRITERS LABORATORIES (UL)

UL-02	(1991) Electrical Appliance and Utilization

UL 197	(Jul 23, 1987; 7th Ed; Rev thru Apr 17, 1991) Commercial Electric Cooking Appliances
UL 207	(1993; Rev thru Mar 1995) Refrigerant-Containing Components and Accessories, Nonelectrical
UL 471	(1992) Commercial Refrigerators and Freezers
UL 710	(Dec 21, 1990; 4th Ed) Grease Extractors for Exhaust Ducts
UL 1046	(Jul 30, 1979; 2nd Ed) Grease Filters for Exhaust Ducts

1.2 GENERAL REQUIREMENTS

Food service equipment shall be of the sizes and types shown. Equipment, materials, and fixtures required for use in conjunction with the items to be furnished by the Government shall be furnished and installed by the Contractor. Equipment, materials, and fixtures indicated on the drawings and schedules shown as Contractor furnished, Contractor installed, shall be furnished and installed by the Contractor.

1.2.1 Mechanical, Electrical, and Plumbing Work

Roughing-in and final connection of mechanical, electrical and plumbing systems to fixed movable food service equipment and cold storage assemblies shall be as specified in Section 15400 PLUMBING, GENERAL PURPOSE; and Section 16415 ELECTRICAL WORK, INTERIOR.

1.2.1.1 Strainers, and Shut-Off Valves

Strainers, and shut-off valves furnished under this section shall be as specified under Section 15400 PLUMBING, GENERAL PURPOSE.

1.2.1.2 Control Valves and Pressure Regulators

Control valves, appliance pressure regulators for water, steam, and vacuum breakers, wherever required on food service equipment (chrome-plated where exposed) shall be furnished under this section.

1.2.1.3 Plumbing and Electrical Work

Plumbing and electrical work specified, but not shown, shall be provided in accordance with Section 15400 PLUMBING, GENERAL PURPOSE; and Section 16415 ELECTRICAL WORK, INTERIOR.

1.2.2 National Sanitation Foundation Standards

Food service equipment shall comply with NSF-01. Acceptable evidence of meeting the requirements of the applicable NSF standards shall be any one of the following:

a. A listing of the equipment in the NSF Food Service Equipment Listing and display of the NSF seal on the equipment.

b. A certification issued for special or specific food service equipment by NSF under their special one time contract evaluation and certification.

c. A certified test report from an independent testing laboratory, approved by the Office of the Surgeon General, indicating that the specific food service equipment has been tested and conforms to the applicable NSF

standards.

1.2.3 Verification of Dimensions and Coordination of Project Data

The Contractor shall become familiar with all details of the work and shall advise the Contracting Officer of any discrepancy before performing any work. The Contractor shall perform the following:

a. Horizontal and vertical dimensions shall be verified in the field.

b. Contract drawings and submittal data shall be reviewed for accuracy and completeness.

c. The installed utility capacity and location shall be field checked.

d. Critical systems/components shall be reviewed for application and capacities such as for exhaust hoods, refrigeration systems, fire suppression systems, water, and steam/condensate line sizes and manifold configurations.

e. Delivery shall be coordinated for access through finished openings and vertical handling limitation within the building.

1.2.4 Standard Products

Materials and equipment shall be the standard products of manufacturers regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. The experience used shall include applications of equipment and materials under similar circumstances and of similar size. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

1.2.5 Waste Pulping Products

a. Manufacturer regularly and presently manufactures food waste pulping systems as one of their principal products.

b. Installer has the technical qualifications, experience, trained personnel, and facilities to install specified items.

c. There is a permanent service organization, maintained or trained by the equipment supplier, which will respond to a service call within 24 hours with a fully equipped service vehicle and trained service person. Submit name and address of service organization.

d. Manufacturer has equivalent product presently installed in three installations similar to this project for three years, and has been in satisfactory and efficient operation for that period of time. Submit list of installations.

1.2.6 Equipment Nameplates and Identification Plates

Each item of equipment shall bear a stainless steel, aluminum, or engraved polyester nameplate or identification plate, as standard with the manufacturer, located in a conspicuous position and permanently fastened to the equipment.

Nameplates or identification plates shall be of the size standard with the manufacturer for the particular piece of equipment provided, and shall be of the approximate size in the referenced specification.

Nameplates or identification plates shall reflect the following:

a. Name of the manufacturer/trade name.

b. Serial number, make, and model number.

c. Pertinent ratings, operating characteristics, and other information as standard with the manufacturer.

d. Date of manufacture.

e. Electrical characteristics.

f. Other applicable data, such as flow rate, temperature, pressure, capacity, and material of construction.

Separate equipment identification plates with the contract number marked thereon, shall be securely fastened to the surface of each piece of equipment. The identification plate and information imprinted thereon shall be as permanent as the life expectancy of the equipment to which they are affixed.

1.2.7 Underwriters Laboratories Standards

Electrically operated equipment shall be in accordance with UL-02 and UL 197. Evidence of meeting the requirements of UL shall be any one of the following:

a. Display of UL label on the equipment.
b. A UL listing mark.
c. A certified test report from a nationally recognized independent testing laboratory indicating that the specific food service equipment has been tested and conforms to the applicable UL standards.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-04 Detail Drawings

Food Service Equipment; GA.

Detail drawings consisting of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Detail drawings shall also contain complete wiring, piping, and schematic diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work, including clearances for maintenance and operation.

Brochures shall have front and rear protective covers with labeled project name and include:

a. Index indicating item number, quantity, description, and manufacturer.
b. Fly sheet for each component indicating item number, name, quantity, manufacturer, optional equipment, modification, special instruction, and utility requirements.
c. Catalog specifications sheets and manufacturer's drawings.

Detail drawings by Contractor shall be separate drawings and shall be the contractor's standard sheet size, but not smaller than the contract drawings, and indicate:

a. Food service equipment and cold storage assemblies with itemized schedule.
b. Special conditions drawings indicating size and location of slab depressions, cores, wall openings, blockouts, ceiling pockets, blocking grounds, ceiling and wall access panels, and above ceiling hanger assemblies.
c. Plumbing/mechanical rough-in drawings.

d. Electrical rough-in drawings.

Detail drawings by manufacturer shall be separate drawings; sheet size shall be manufacturer's standard size and indicate:

a. Item number, name, and quantity.
b. Construction details, sections, and elevations.
c. Adjacent walls, columns, and equipment.
d. Plumbing and electrical schematics, and fabricated fixtures with single electrical or plumbing connection.
e. Service access panels required for maintenance or replacement of mechanical or electrical components.

SD-09 Reports

Testing; FIO.

Test reports in booklet format showing all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-19 Operation and Maintenance Manuals

Food Service Equipment; GA.

Six complete copies of the service manual, after approval of the detail drawings and not later than 3 months prior to the date of beneficial occupancy, with data for each different item of material and equipment specified. Manuals will be submitted in accordance with the requirements of Section: 01800, EQUIPMENT OPERATING, MAINTENANCE, AND REPAIR MANUALS. Service manuals shall include:

a. Front and rear protective covers with labeled project name.
b. Index indicating item number, quantity, description, manufacturer's name, and model number.
c. Maintenance instructions for stainless steel and plastic laminate.
d. Manufacturer's catalog specification sheets and manufacturer's detail drawings.
e. Manufacturer's operation manual outlining the step-by-step procedures for equipment installation, startup, basic operation features, and operation shutdown.
f. Manufacturer's maintenance manual listing routine maintenance procedures, possible breakdowns, repairs, and troubleshooting guides. The instructions shall include simplified diagrams for the equipment as installed.
g. Manufacturer's list of parts and supplies with current unit price and address of manufacturer's parts supply warehouse.

1.4 DELIVERY AND STORAGE

1.4.1 Delivery

Unless otherwise directed, the following procedures shall apply:

a. Field assembled fixed equipment integrated into structure shall be sent to jobsite when required.
b. Fixed equipment not integrated into structure shall be sent to the jobsite after completion of finished ceilings, lighting, and acidizing of the finished floor and wall systems, including painting.
c. Major movable equipment shall be delivered to inventory in a secured area for interim jobsite storage, or if secured area is not available, when fixed equipment installation/clean-up has been completed.
d. Minor appliances and loose items shall be delivered to the jobsite when the Contracting Officer is prepared to receive and inventory such items.

1.4.2 Storage

All items delivered and placed into storage shall be stored with protection from weather, humidity, and temperature variation, dirt and dust, or other contaminants.

1.4.3 Protection of Fixed/Fabricated Manufactured Equipment

Fiberboard or plywood shall be taped to surfaces as required by equipment shape and installation access requirements.

1.4.4 Prohibited Use of Equipment

Food service equipment shall not be used as tool and material storage, work bench, scaffold, or stacking area.

1.4.5 Damaged Equipment

Contractor shall immediately submit documentation to the Contracting Officer with a recommendation of action for repair or replacement and the impact on project schedule.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the following:

2.1.1 Black Iron Pipe

ASTM A 53.

2.1.2 Brass Pipe

ASTM B 43.

2.1.3 Chromium Plating of Brass Pipe, Valves, and Fittings

FS WW-P-541/GEN and FS WW-P-541/8.

2.1.4 Copper Tubing

ASTM B 88, Type K or L, or ASTM B 75, as required to suit application.

2.1.5 Stainless Steel, Nonmagnetic

ASTM A 167 or ASTM A 240: 18-8, Type 302, polished to No. 4 finish.
(Reference SMACNA appendix A-2 page 9.10)

2.1.6 Stainless Steel Pipe and Tubing

Pipe and tubing shall be seamless or welded, of the gauge specified, of true roundness, and of material as specified for stainless steel. Seamless tubing shall be thoroughly annealed, pickled, and ground smooth. Welded tubing shall be thoroughly heat-treated, quenched to eliminate carbide precipitation and then drawn true to size and roundness, and ground. Tubing shall be given a No. 3 or 4 finish when exposed to view.

2.1.7 Fittings for Copper Tubing

Fittings on tubing shall be of solder-joint type. Flared joint fittings may be used in specific applications when approved. Cast-bronze solder joint fittings shall conform to ASME B16.22. Cast-bronze fittings for flared joints shall conform to ASME B16.26.

2.1.8 Fittings for Brass Pipe

FS WW-P-460, Class A or B, shall be as required for application.

2.1.9 Galvanizing Repair Compound

ASTM D 520, Type I.

2.1.10 Silver Solder

FS QQ-B-654, class shall be as applicable.

2.1.11 Steel Structural Shapes for Framing

ASTM A 36. Structural shapes shall be uniform, ductile in quality, and shall be free of hard spots, runs, checks, cracks and other surface defects. Sections shall be galvanized by the hot-dip process, conforming to ASTM A 123, coating designation G-90.

2.1.11.1 Paint and Coatings

Paint and coatings shall be of a durable, nontoxic, nondusting, nonflaking, and mildew-resistant type, suitable for use with food service equipment and in conformance with NSF Std 2. Application shall be in accordance with the recommendations of the manufacturer.

2.1.11.2 Exterior Parts

Exterior, galvanized parts, exposed members of framework, and wrought steel pipe, where specified to be painted, shall be cleaned, degreased with mineral spirits, and primed with rust inhibiting primer, and finished with two coats of epoxy-based gray hammertone paint, unless otherwise specified.

2.1.12 Tin-Antimony Solder

FS QQ-S-571, Composition 95/5.

2.2 CONSTRUCTION OF FABRICATED EQUIPMENT

2.2.1 Welding

2.2.1.1 Welding Rods

Welding shall be done with welding rods of the same composition as the sheets or parts welded.

2.2.1.2 Weld Quality

Welds shall be strong and ductile. Welds shall be free of imperfections such as pits, runs, spatter, cracks, and shall be finished to have the same color as the adjoining surfaces. Butt welds made by welding straps under seams, or by filling in with solder, or by grinding will not be acceptable. Welded joints shall be homogeneous with the sheet metal. Spot welding shall not be substituted for continuous welding. Joints in tops of counters, tables, drainboards, exposed shelving, and sinks shall be joined by heli-arc welding or a process other than carbon-arc welding or one that will permit carbon pick-up. Joints shall be fully welded. Counter tops shall be factory welded into lengths as long as practical in order to reduce field welded joints to a minimum. All welds shall be ground smooth and free of burrs and sharp edges. Wherever welds occur on nonfood contact surfaces not suitable for grinding or polishing, such welds and the accompanying discoloration shall be sandblasted and coated in the factory with a nontoxic metallic-base paint. Bolts and screws shall be welded by a process that will minimize the possibility of carbide precipitation. Welds in galvanized steel made after galvanizing, and the adjacent areas where galvanizing is damaged, shall be cleaned and coated with galvanizing repair compound.

2.2.2 Soldering

Soldering shall serve only as a filler to prevent leakage and shall be made with tin-antimony solder, conforming to FS QQ-S-571. Stainless steel requiring soldering shall first be cleaned of discoloration and then have a soldering flux applied. Excess or remaining flux shall be washed clean after the soldering has been completed, and the entire soldered joint and adjacent metallic surfaces shall be cleaned with a liquid alkaline or neutralizing agent to prevent any attack on the surrounding metallic surfaces by the soldering flux.

2.2.3 Brazing

Brazing shall be accomplished with silver solder. Brazing shall be used only on copper tubing to brass and bronze connection fittings. Steam coils requiring dip-tinning shall first be brazed with all surplus flux removed so that metal is exposed and then tinned.

2.2.4 Grinding, Polishing, and Finishing

Exposed welded joints shall be ground smooth and finished to match the adjoining material. Wherever materials have been depressed or sunken by welding operation, such depressions shall be hammered and peened flush with the adjoining surface, and again ground to eliminate high spots. Ground surfaces shall then be polished or buffed to match adjoining surfaces.

Care shall be exercised in the grinding operations to avoid excessive heating of the metal and metal discoloration. Abrasives, wheels, and belts used in grinding shall be free of iron and shall not have been used on carbon steel. In all cases, the grain of rough grinding shall be removed by several successively finer polishing operations. The texture of the final polishing operation shall be uniform, smooth, and consistent. The grain direction of horizontal stainless steel surface shall be longitudinal, including the splash back. Polishing at right angle corners shall provide a mitered appearance. Butt and contact joints shall be close fitting and not require solder as a filler. Wherever brake bends occur, the bends shall be free of open texture or orange peel appearance. Where brake work does mar the uniform appearance of the material, such marks shall be removed by grinding, polishing, and finishing. Sheared edges shall be free of burrs, projections, and fins. Where miters or bullnosed corners occur, such miters and corners shall be finished with the underage of the material and ground to a uniform condition. Overlapping of material is not acceptable. Exposed stainless steel surfaces shall have a No. 3 or 4 finish. Finishes of materials, other than stainless steel, shall be comparable in appearance to commercial mill finish. Exposed surfaces shall include:

a. Exterior surfaces exposed to view.
b. Interior surfaces exposed to view in doorless cabinets.
c. Undersides of shelves shall have a ground finish of No. 90 grit or finer.

2.2.5 Chromium Plating

Chromium plating, where used, shall be applied over nickel plating.

2.2.6 Fastening Devices

Fastening devices shall be of the same material as the metal being joined when joint pieces are of similar metal. Fastening devices shall be stainless steel when stainless steel is joined to dissimilar metal. Stud bolts shall be 1/4-2O stainless steel with length necessary to accept washers, lock washers, and required nuts, and shall be welded 225 mm on center maximum. Exposed surfaces of equipment shall be free of bolts, screws, and rivet heads. Stainless steel stud bolts shall be used to fasten tops of counters or tables to angle framing and trim to other surfaces. Such bolts shall be of the concealed type. Threads of stud bolts which are on the inside of fixtures and are either visible or might come in contact with a wiping cloth, shall be capped with chrome plated washers, lock washers, and chromium-plated brass cap nuts. Wherever bolts are welded to the underside of trim or tops, the reverse side of the welds shall be finished uniform with the adjoining surface of the trim or the top. Dimples at these points will not be acceptable.

2.3 COUNTERS

Counters shall be constructed in accordance with applicable portions of NSF Std 2.

2.3.1 Counter Tops

Counter tops shall be constructed of 1.9 mm (14-gauge) stainless steel with all seams and corners welded, ground smooth, and polished.

2.3.2 Cafeteria Counters

Cafeteria counters shall be constructed and sound deadened as indicated and as specified for counters.

2.3.3 Pitch and Drainage of Equipment Surfaces

Wherever a fixture has a waste or drain outlet, the surface shall have a distinct pitch toward such outlet. Corners shall be coved on 19 mm radius and sloped 10 mm per m maintaining level crown at front edges of rolled rims, marine edges, and backsplashes, when tops are sloped to drains.

2.3.4 Drip Gutter

Drip gutter shall be an integral part of the counter top and located below beverage dispensing faucets where indicated. Drip gutter shall be provided with a 25 mm brass drain tube centered in the bottom of the gutter. Bottom shall be pitched to the drain. The drip gutter shall be 130 mm, 50 mm deep, and the length indicated. The drip gutter shall be provided with a 130 mm wide, 50 mm high, removable, nonsplash, stainless steel, wire mesh strainer with frame.

2.3.5 Counter Edges and Backsplashes

2.3.5.1 Counter Edges

Counter edges shall be one of the following types:

a. Turned Down: 38 mm at 90 degrees with 13 mm kink back at bottom, turned in 60 degrees from vertical. Free Corners shall be rounded.

b. Box Channel Edge: Turned up 19 mm at 45 degree angle, turned out 25 mm horizontally, and turned down 38 mm at 90 degree angle with 13 mm kink back at bottom, turned in 60 degrees from vertical.

c. Square Channel Rim: Coved up 75 mm with 38 mm wide horizontal rim and turned down 38 mm at 90 dregree angle with 13 mm kink back at bottom, turned in 60 degrees from vertical. Free corners shall be square.

2.3.5.2 Counter Backsplash

Counter backsplash shall be one of the following types:

a. Coved up 200 mm and sloped back 50 mm at the top on a 45-degree angle. Turned down 25 mm at 135 degrees at the rear of the splash with the ends closed to the bottom of the top turn down. Splash turn down shall be secured to wall with 100 mm long, 1.9 mm (14-gauge) stainless steel "zee" clips anchored to wall, 900 mm on center.

b. Turned up 100 mm at 90 degrees on 16 mm radius with edge turned back 25 mm at 90 degree angle with 25 mm turn down at 90 degrees at rear of splash with the ends closed to the bottom of the top turned down. Splash turn down shall be secured to wall with 100 mm long, 1.9 mm (14-gauge) stainless steel "zee" clips anchored to wall, 900 mm on center.

2.3.6 Counter Top Support Angles

Counter top support angles shall be 25 mm by 100 mm by 25 mm, 1.9 mm stainless steel with all corners mitered, welded, and ground smooth at perimeter. Cross members shall be provided on 600 mm centers maximum. A 100 mm by 100 mm, 2.7 mm (12-gauge) stainless steel triangular pad shall be provided where leg gussets are welded to the frame. Angle frame shall be stud bolted to counter top.

2.3.7 Sound Deadening of Counters

Counter tops shall be sound deadened with 13 mm wide rope sealant positioned continuously between all contact surfaces of the frame-members and the underside of counter top, overshelves and undershelves. Stud bolts shall be tightened for maximum compression and the excess sealant trimmed.

2.4 COUNTER BASES

Counter bases shall be open or closed as indicated.

2.4.1 Closed Bases

Closed bases shall be constructed with 38 mm by 38 mm, 1.9 mm (14 gauge)stainless steel angle with all corners mitered, welded, and ground smooth. Horizontal and vertical angles shall be provided on 600 mm centers or less. The enclosure panels on closed bases shall be of 1.3 mm (18-gauge) stainless steel. Joint trim on enclosed bases shall be 50 mm wide, 1.9 mm (14-gauge) stainless steel, attached with concealed stud bolts and sealed to interior partition. Enclosed bases shall be double walled on interior, exposed ends, and at interior exposed partitions. Service access shall be provided for utilities supplying equipment designed to fit atop the counter.

2.4.2 Open Bases

Open bases shall be constructed of 41 mm outside diameter, 1.6 mm (16-gauge) stainless steel rails welded 360 degrees to the legs.

2.4.3 Gussets

Gussets shall be stainless steel, fully enclosed, a minimum of 75 mm in diameter at the top, reinforced with a bushing, and shall be continuously welded to channel or angle.

2.4.4 Legs

Legs shall be of 1.6 mm (16-gauge), 41 mm outside diameter stainless steel tubing. Legs shall be continuously welded to gussets, channel, or angle as specified.

2.4.5 Feet

Feet shall be sanitary, die-stamped stainless steel bullet-shaped, fully enclosed and shall provide for a 25 mm adjustment. The bottom of the legs shall be finished off smoothly and the stem overlapped to provide a sanitary closed fitting. Feet for free-standing fixtures requiring utility connections shall be as above except with a flanged plate at the bottom which shall be anchored to the floor with noncorrosive bolts.

2.4.6 Undercounter Shelving

2.4.6.1 Open Base Shelves

Open base shelves shall be constructed of 1.6 mm (16-gauge) stainless steel with all edges turned down 38 mm at 90 degrees with a 13 mm kink back at bottom, turned in 60 degrees from vertical. Corners shall be notched a full 90 degrees and welded from underside to completely fill the gap, ground and polished. Undershelf shall be braced with 25 mm by 100 mm by 25 mm, 1.9 mm (14 gauge) stainless steel channel at longitudinal center line and between each intermediate pair of legs.

2.4.6.2 Closed Base Shelves

Interior shelves on closed bases shall be constructed of 1.6 mm (16-gauge) stainless steel. Side edges of the shelf shall be turned up 38 mm at 90 degrees on a 6 mm radius and sealed to the side walls. Rear of the shelf shall be coved up 38 mm at 90 degrees on a 16 mm radius. Vertical joints shall be sealed. Front edge shall be turned down 38 mm at 90 degrees with 13 mm kink at bottom, turned in 60 degrees from vertical. The vertical seam of shelf turn down/turn up shall be welded to the face of body partition. Maximum depth of shelves shall be 700 mm. Shelves shall be reinforced with 25 mm by 100 mm by 25 mm, 1.9 mm (14-gauge) stainless steel closed hat

channel. Shelf slides, where indicated, shall be 1.9 mm (14-gauge) stainless steel, 38 mm by 38 mm angles, and shall have front and back corners rounded and finished smooth.

2.4.7 Tray Slides

Tray slides shall be solid type. The width of the tray slides shall not be less than 355 mm. The mounting height of the tray slides shall be 825 mm above the finished floor. Tray slides shall be installed true and level. Tray slide shall be designed and installed to preclude tray spillage.

2.4.7.1 Solid Type Slide

Solid type slide shall be constructed of 1.9 mm (14-gauge) stainless steel with the front edge and ends turned down per 2.3.5.1.a. The back edge of the slide shall be turned up 38 mm at 90 degrees behind counter top turn down. Ends of the slide shall be closed to eliminate sharp edges.

2.4.7.2 Support Brackets

Support brackets for tray slides shall be stainless steel, and shall be secured to the trim strip of the counter with stainless steel truss head bolts. Brackets shall not be spaced more than 1,200 mm, center to center.

2.4.8 Protector Shelf

Protector shelf shall be installed on the serving line counters and shall be located over the equipment as indicated.

Protector/serving shelf shall be constructed of 25 mm square, 1.6 mm (16-gauge) stainless steel tubing in configuration shown on detail. Supports shall be secured to top with concealed bolts on the underside. Top of protector shall have a 180 mm wide, 1.9 mm (14 gauge) stainless steel shelf formed down 80 mm on all sides.

2.4.8.1 Heat Lamps

Heat lamp units shall be provided with consolidated chassis of longest possible length for multiple sections. Heat lamp units shall have integral incandescent display light with warm white lamps, and shall be wired to a recess mounted pilot light and infinite control for each separate section. Heat lamps shall be secured tightly to the underside of the serving shelf and shall have a "USDA" approved thermal breaker provided between the heat lamps and the shelf the full size of heat lamp chassis. Each 600 mm heat lamp section shall be located above two food wells. Maximum allowable temperature at the top of a serving shelf shall be 49 degrees C (120 degrees F).

2.4.8.2 Fluorescent Display Light Modules

Fluorescent display light modules (not included with heat lamps) shall be in 450 mm and 900 mm increments, each with warm white lamps. Display lamps shall be wired to a single recess mounted master switch per serving shelf.

2.4.8.3 Heat Lamp/Display Wiring

Heat lamp/display wiring shall be concealed in a corner post.

2.4.8.4 Protector Glass

Protector glass sheet shall be no less than 6 mm thick in transparent, tempered plate glass or heat- and mar-resistant clear acrylic framed in an all welded stainless steel channel edging and shall be installed under the protector shelf and in front of the food display. At the top and bottom of the installed glass shall be a 25 mm space for vapor venting. The protector glass or clear acrylic shall be pivoted for easy cleaning. Design shall be such that glass or clear acrylic can be replaced in the event of breakage.

2.5 DISH COUNTERS

Dish counters shall be constructed and sound deadened as indicated and as specified for counters. The dish counters shall be fitted and flanged into the dishwashing machine with a water-tight joint.

2.5.1 Dish Counter Support Channels

Dish counter support channels shall be 25 mm by 100 mm by 25 mm, 2.7 mm (12-gauge) stainless steel. Channels shall be provided under dish counter top between each pair of legs and shall have closed ends. Cross members, on the centerline, shall be provided between legs. Channels shall be stud-bolted to counter top at 150 mm on center, maximum.

2.5.2 Dish Counter Components

2.5.2.1 Prewash Sink

Integral prewash sink shall be 700 mm by 700 mm with a 25 mm vertical top flange welded to the dish counter top with the corners rounded on 13 mm radius. The sink body shall be tapered from the bottom edge of the flange to 150 mm below dish counter surface and shall be provided with a disposer throat flange.

2.5.2.2 Prerinse Spray

A prerinse spray assembly shall be mounted on the backsplash of the dish counter with vertical tubing, wall bracket, flexible gooseneck hose, and self closing squeeze-type valve and spray.

2.5.2.3 Undershelves

Undershelves shall be the solid type, and shall be constructed as specified for open base shelves.

2.5.2.4 Scraping Trough

Scraping trough in the soiled dish counter shall be 1.9 mm (14-gauge) stainless steel with all corners coved, and shall be integrally welded to the dish counter. A 150 mm (6-inch) wide trough shall be sloped from 80 mm depth to integral disposer. One inlet fitting shall be installed at the shallow end of the scraping trough. Inlet fittings shall be piped to a vacuum breaker, and shall have a quarter turn valve at each inlet. Integral disposer sink shall be 250 mm by 250 mm by 188 mm deep, 1.9 mm (14-gauge) stainless steel with all corners coved, welded to dish counter/scraping trough and shall be fitted with a removable silverware-trap. Removable flush cover shall be 1.6 mm (16-gauge) stainless steel, 13 mm pan-formed, and perforated 13 mm holes punched at 38 mm inches on center with welded corners. A finger ring shall be provided for the removal of the cover. Support tabs shall be integrally welded to inside face of the disposer sink so that cover is flush with top.

2.5.3 Glass/Cup Rack Overshelf

Glass/cup rack overshelf shall be 1.9 mm (14-gauge) stainless steel with a 38 mm wide by 38 mm deep trough on the front, with the front edge turned down per 2.3.5.1.a. Shelf shall be sloped on a 25 degree angle and thr rear edge shall be formed up 38 mm against the wall. Ends of shelf shall be weldrd closed.

a. Bottom edge of shelf shall be suspended at 350 mm above counter top on 1.9 mm (14 gauge) stainless steel shelf brackets.

b. A 25 mm stainless steel drain tube shall be provided at one end of trough, formed back to wall, down through the backsplash to the floor drain below.

2.6 CONVEYOR

Conveyor shall be roller assemblies type as noted in PART 4 EQUIPMENT SPECIFICATIONS paragraph below, gravity operated, soiled dish type, to transport standard 350 mm x 450 mm cafeteria trays constructed in accordance with NSF Std 2 in two areas and dish racks in others, and shall be of the size and configuration indicated in the drawings.

2.6.1 Trough

The conveyor shall have a one-piece seamless pan constructed of 1.9 mm (14-gauge) stainless steel. All horizontal and vertical corners shall be reinforced with 2.7 mm (12-gauge) stainless steel closed channels. Conveyor pan edges shall be turned up 75 mm at 90 degrees to form rolled rim. Pan shall be sized to transport standard 356 mm x 457 mm cafeteria trays. Slider pan shall be mounted on "U" shaped supports of 2.7 mm (12-gauge) stainless steel, at 1500 mm on center. Legs shall be provided as specified for gussets, legs, and feet.

2.6.2 Roller Assemblies

Roller sections to be stainless steel, tubing style, with stainless steel ball bearings. Rollers to be mounted on stainless steel side rails formed to maintain trays in proper alignment with top and bottom hemmed for added rigidity. Each section end of frame fitted with stainless plate notched for easy removal. Roller section mounted in trough to allow for free movement of trays without drag.

2.6.3 Waste Pulping System

All componets, excluding piping, of the waste pulping system shall be supplied by a single manufacturer. The system shall be capable of processing the amount of waste noted in PART 4 EQUIPMENT SPECIFICATIONS paragraph below.

2.6.3.1 Extractor

1. Press assemply fabricated of corrosion resisting stainless steel including housing, screw assembly, discharge assembly and other componets in contact with slurry or extracted pulp.
2. Automatic wash down of screen with fresh water.
3. Controled moisture content of extracting pulp.
4. Totally enclosed fan cooled motor mounted to gear reducer.
5. Extracted waste return pump to pulpers for re-use; pump with fresh water flushed mechanical seal to protect drive shaft.
6. Diaphragm actuated additive injector pump(s) with 19 liter additive tank for defoamer, deodorizer, disinfectant and cleanser.
7. Wall mounted NEMA 4 enclosure pre-wired control panels magnetic circuit breakers interlocked with door handle, low voltage and three leg thermal overload protection.
8. Chemical treatment for vermin and odor control.

2.6.3.2 Waste Pulping Disposer and Waste Pulping Unit

1. Housing: Cast iron, corrosion resisting stainless steel, or corrosion resisting aluminum alloy with water connection into grind chamber.
2. Grind ring: Rust resistant steel alloy with cutting teeth hardened and precision ground. Replaceable without replacing housing.
3. Rotor: Rust resistant alloy with hardened steel impellers, connected directly to motor shaft and dynamically balanced. Replaceable without replacing other components.
4. Motor: Continuous duty, splashproof, permanently lubricated, vertical shaft, with water seal.
5. Control Center: Prefabricated, containing:

    a. Magnetic starter.
    b. Solenoid valve.
    c. Time delay relay.
    d. Control circuit transformer.
    e. Floor control interlock switch.
    f. CRS NEMA 4 enclosure to house (1.) through (5.).
6. On-Off switch: Push buttons in corrosion resisting stainless steel NEMA 4 enclosure mounted on table near disposer.
7. Floor Stand.

8. Silver Trap.
9. Accessories: Corrosion resisting stainless steel cone and cover.

2.7 SINKS

Sink shall be of the dimensions indicated and conform to the applicable requirements of NSF Std 2. Sinks shall be constructed of a minimum of 1.9 mm (14-gauge) stainless steel. Vertical and horizontal corners shall be rounded to a radius of not less than 19 mm with double walls at partitions. Continuous 1.9 mm (14-gauge) stainless steel exterior filler panels shall be provided between compartments of multiple-compartment sinks and shall be ground and polished to match the adjacent surfaces. The sink bottom shall be scored and sloped to assure drainage to the waste outlet. Sinks shall be equipped with waste fittings, drain plugs with quick-opening valves, and faucets of the type specified. Faucet and drain plug, shall be required for each sink compartment, unless otherwise indicated. Spout outlet of faucets shall be a minimum of 125 mm above the rim of the sink. Sink legs shall be as specified for counters, except that closed gussets shall be welded to the support channels. Sinks installed adjacent to walls or enclosures shall be anchored and sealed thereto. Sinks shall be sound-deadened as specified for counters.

2.7.1 Plumbing/Trim Requirements

2.7.1.1 Drain Plug Fittings

Drain shall consist of a 38 mm quick opening brass body valve with a stainless steel twist lever handle. Removable perforated stainless steel strainer plate shall be not less than 75 mm in diameter.

2.7.1.2 Backsplash-Mounted Faucets

Backsplash-mounted faucets shall be combination fitting-type with an exposed body and concealed supply connections at the back of the sink. Fitting shall have 13 mm NPT hot and cold inlets on 203 centers. Faucets shall have a 221 mm wide x 298 mm swivel gooseneck spout. The spout outlet shall be 130 mm above the spout connection and fitted with an aerator. Faucet shall have 60 mm chrome-plated metal lever handles and replaceable seats. Specification is based on T & S Model #B-0331 with Model #135X swivel gooseneck spout with aerator.

2.7.1.3 Counter Top or Ledge-Mounted Faucets

Counter top or ledge-mounted faucets shall be combination fitting-type with a concealed body and with the supply connections under the countertop. Faucets shall have 13 mm NPT hot and cold inlets on 203 centers. Faucets shall have a 221 mm wide x 298 mm swivel gooseneck spout. The spout outlet shall be 130 mm above the spout connection and fitted with an aerator. Faucet shall have 60 mm chrome-plated metal lever handles and replaceable seats. Chrome-plated copper alloy or stainless steel escutcheons together with coupling nuts, and 13 mm pipe size union-tailpieces shall be provided. Specification is based on T & S Model #B-0321 with Model #135X swivel gooseneck spout with aerator.

2.7.1.4 Backflow Preventers

Backflow preventers shall be provided at each item of food service equipment having a water supply and waste connections, where the water inlet is connected below the flood level of the equipment. Backflow preventer shall be supplied of a size and proportion that will allow an ample flow of water to the equipment, but will prevent the backflow of waste or polluted water into the water supply system. Backflow preventers shall be as specified in Section 15400 PLUMBING, GENERAL PURPOSE.

2.7.1.5 Water-Fill Faucets

Specialty food service water-fill faucets or hose assemblies shall be provided as indicated in drawings/specifications.

2.7.1.6 Water Hammer Arresters

Water hammer arresters shall be provided for food service equipment with quick-opening or solenoid-operated

water valves. Each unit shall be installed in a vertical position.

2.7.1.7 Control Valve Mountings

Gusset-shaped 1.9 mm (14-gauge) stainless steel panel for the control valves shall be mounted on open base fixtures with 88 mm setback from the countertop edge/rim to the valve handle.

2.7.2 Pot Washing Sinks

2.7.2.1 Final Rinse Compartment

The final rinse compartment of the pot washing sink shall be equipped for hot water sanitizing, using a booster heater and a sink mounted heater.

2.7.2.2 Temperature Gauge

Temperature gauge shall have a 75 mm diameter face with stainless steel flange.

2.7.2.3 False Bottom

False bottom shall be constructed of 1.9 mm (14 gauge) stainless stell, 13 mm deep pan formed with perforated top holes punched 38 mm on center, and shall have welded corners and finger rings. False bottom shall be fitted with 50 mm high x 31 mm outside diameter tubular stainless steel feet with closed ends.

2.8 DRAIN TRENCH LINER/CRATING

Drain trench liner/crating shall be of 1.9 mm (14-gauge) stainless steel in sizes as indicated and formed in accordance with detail.

2.8.1 Interior of the Liner

Interior of the liner shall be 50 mm deep with corners coved on 19 mm radius; sloped and scored 25 mm to an integrally welded sump drain with removable stainless steel sediment baskets. Drain shall be fitted with 130 mm long welded tailpiece. A safety chain shall be connected to the sediment basket and the top of the liner wall.

2.8.2 Stainless Steel Grating

Stainless steel grating shall be removable, with 25 mm by 5 mm bearing bars. Bearing Bars Shall be set for 21 mm clearence and grating shall be open on the ends. Bearing bars shall be connected with 13 mm stainless steel rods set 75 mm in from eachend, with three rods on grating over 380 mm. Bearing bars shall run from to rear as shown on plan.

2.9 HOODS

Design, fabrication, air flow rate and installation of hoods and duct systems shall conform to ACGIH-01, NFPA 96, and UL 710, and UL 1046 where applicable to automatic washdown hood systems, and UL 1046 where applicable to filter hood systems. These standards represent only the minimum requirements; subsequent subsections of this clause may require construction that exceeds these minimum requirements. Hood duct systems, grease removal devices, and cooking which may be a source of ignition of grease in the hood or duct, shall be protected with fixed pipe systems and provided with portable fire extinguishing equipment in accordance with NFPA 96, NFPA 17A, and as specified. Unless otherwise specified, ducts and hoods shall be secured to building so as to be level and free from vibration under all conditions of operations. Supply and installation of exhaust fans for food service equipment and exhaust hoods shall be as specified in Section 15935 VENTILATION AND EXHAUST SYSTEM.

2.9.1 Exhaust Hood Connections Provisions

2.9.1.1 Exhaust Duct for Canopy or Noncanopy Hoods

Exhaust duct for canopy or noncanopy hoods shall be constructed of 1.3 mm (18-gauge) stainless steel and shall have all external seams welded continuously, liquid-tight. Duct size shall be based on a minimum air velocity of 7.6 m per second and maximum of 12.7 m per second. Duct shall be continuously welded, liquid tight, to hood duct collar as required by NFPA 96.

2.9.1.2 Hood Support

Wall mounted or island type hoods shall be supported from the ceiling structure with stainless steel mounting brackets provided with hoods. Hanger rods shall be 13 mm diameter stainless steel, threaded at the bottom and designed at the top to fit into inserts in building slats above or shall have hanger attachments fastened to structural steel members. Hanger rods shall be spaced 1,200 mm on center, maximum.

2.9.1.3 Make-Up Air Tempered

The air volume which is exhausted from a kitchen shall be replaced as required by NFPA 96. A fire activated damper of at least the same gauge as the hood shall be installed in the supply plenum at the same plane as the external weld. Air supplied upstream of the hood suction opening does not qualify as make-up air. The exhaust air flow rate for ventilation of cooking equipment shall be drawn through the open area between cooking surfaces and the perimeter entrance of the hood. Make-up air diffusers shall be provided at the front panel, the exterior length of the hood producing a low velocity discharge. The supply air plenum shall have 25 mm thick foil-faced fiberglass insulation at interior of plenum. The temperature differential between make-up air and the air in the conditioned space shall not exceed 5 degrees C, except air that is part of the air conditioning system or air that does not decrease comfort conditions of the occupied space.

2.9.1.4 Hood Lights and Wiring

This section shall provide as indicated on the drawing, recess mounted vapor proof fluorescent fixtures the full length of hood. The light fixtures shall be prewired to junction box at a rear free corner of the hood.

2.9.1.5 Closure Panels

Exhaust hood closure panels shall be 13 mm pan-formed, 1.3 mm (18-gauge) stainless steel. Upper edge of panels shall be secured to the ceiling. Lower edge of panels shall be secured to top edge of hood.

2.10 Ducts at Dishwashing Machines

Ducts at dishwashing machines shall consist of two vertical ducts, one at each end of the dishwasher. Exposed, seamless, ducts shall be constructed of not less than 1.3 mm (18-gauge) stainless steel and shall be sized to accommodate the machine exhaust vent. The intake of each duct shall be at the top edge of the dishwasher and the ducts shall extend to 150 mm above the finished ceiling for final connection. The duct shall be trimmed at the ceiling with a 1.6 mm (16-gauge) stainless steel angle flange with all corners welded. The exhaust outlet shall be connected to the exhaust system.

2.11 PREFABRICATED WALK-IN REFRIGERATORS

Refrigerators shall be prefabricated, commercial, walk-in type intended for use in dining facilities. Units shall conform to UL 471 and NSF Std 7 floorless, design type and size as indicated, and the following:

2.11.1 General Requirements

2.11.1.1 Closure Panels

Closure panels and/or trim strips to the building walls and ceiling shall be installed with concealed attachments. Closure/trim shall be of the same material as the wall panels unless otherwise noted.

2.11.1.2 I-Beam Supports

Wherever compartment dimension exceeds the clear-span ability of ceiling panels, self supporting channels shall be provided on the exterior of the ceiling. Beams or posts within compartments will not be acceptable.

2.11.1.3 Identification Signs

Engraved phenolic plastic compartment identification signs 300 mm by 50 mm high in Contracting Officer's selection of color with 25 mm letters shall be mounted on door above view window.

2.11.1.4 Door

Door panel inner and outer skins shall be 1.3 mm (18 gauge) stainless steel. Doors shall be filled with insulation 100 mm thick. Safety hardware shall conform to NSF Std 2. Hardware shall be stainless steel.

2.11.1.5 Strip Curtains

Transparent, flexible, vinyl-reinforced strip curtains shall be provided which are able to be replaced individually and anchored at top. Strip shall be a minimum 800 mm in width and 2 mm thick.

2.11.1.6 Door Stops

Door stops shall be provided, where necessary, to prevent walk-in refrigerator doors from striking adjacent walls, plumbing fixtures or food service equipment when door is open.

2.11.1.7 Protective Bumpers

Bumpers shall be as noted in the "DESCRIPTION."

2.11.1.8 Gasket

Gasket material shall be either natural or synthetic rubber. Where frames are used, the panels shall fit together with gaskets that are designed for 50 percent compression.

2.11.2 Floorless Refrigerator Floors

Floorless refrigerator floors shall be flush with the surrounding building floor. The built-in floor shall be provided with two layers of 50 mm thick polyurethane board insulation with staggered joints set in mastic. In addition, a watertight seal formed by 0.152 mm (6 mil) polyethylene sheets with all joints lapped 150 mm and sealed, shall be provided on the surface of the subfloor which will support the insulation and the refrigeration floor. A 6.75 kg felt slip sheet shall be provided over insulation with 150 mm lapped joints flashed up the height of finished floor base. The subfloor and refrigerator floor shall each be not less than a 100 mm thickness of reinforced concrete with the insulation sandwiched between. The subfloor shall contain drain holes to drain water seepage. Beneath the floor screeds at refrigerator walls and partitions, shall be breaker strips constructed of redwood or .40 ground contact CCA pressure treated wood. Breaker strips shall be 38 mm wide and shall extend from the finished floor down to the bottom slab. The subfloor shall be supported on a fill of 50 mm clean rock aggregate having a minimum depth of 375 mm (15 inches). In addition, the perimeter shall be embedded within the gravel fill to allow for air circulation.

2.11.3 Refrigeration Systems

Refrigeration equipment for cold storage facilities shall be as specified in Paragraph 4.2 Schedule Of Food Service Equipment.

2.11.3.1 Unit Coolers

Unit coolers shall be of specified quantity and model numbers and shall be ceiling-hung by 13 mm outside diameter nylon bolts with stainless steel washers and nuts. Hanger bolts shall be inserted through plastic sleeve with the penetrations sealed airtight.

2.11.3.2 Drain Fittings

Unit cooler drain fittings shall be positioned as indicated on the drawings. Cast tee-fittings shall be installed on drain pan outlet with union and cleanout plug and shall have a 25 mm copper drainline extended through a wall panel to an air-gap fitting or floor drain.

a. Drainline shall be sloped 42 mm perm, trapped at exterior of the assembly, and shall turn down into drain. Drain lines of adjacent compartments shall be manifolded wherever possible.

b. Plastic sleeve shall be installed through the compartment wall, and sealed around the drainline. A stainless steel escutcheon shall be installed with set screws at the exterior of the wall.

c. Electric drainline heater cable shall be provided with a minimum rating of 100 watt per lineal meter (30 watt/lineal foot), 208 volts, single phase. The drain line shall be wrapped with a maximum 50 mm loop spacing and interwired to the unit cooler for continuous operation.

2.11.3.3 Rack-Mounted Condensing Unit Assemblies

Rack-mounted condensing unit assemblies shall be air-cooled units. Each unit shall be fitted with a prewired control panel.

a. Oil separator shall be provided for all compressors that are positioned higher than the coil, 2.238 kw or larger, located more than 15.2 m from coil, and all freezer systems. The separator shall be piped to compressor crankcase with a shut-off valve in return line.

b. Condensing units installed in an area subject to weather conditions or low ambient temperatures shall be furnished with stainless steel enclosure.

c. A 300 mm by 50 mm engraved phenolic plastic condenser identification sign shall be mount on the rack below each condenser in Contracting Officer's selection of color with 25 mm letters.

2.11.3.4 Electrical Conduit

EMT conduit with pull-wire and wide-sweep bends shall be installed for refrigerant piping to remote food service equipment refrigeration systems and shall be sealed at both ends with silicone foam.

2.11.3.5 System Start Up

Evacuation and charging after completion of pressure test shall be as specified in Paragraph 4.2 Schedule Of Food Service Equipment.

2.12 ELECTRICAL WORK

Electrical systems, components and accessories shall be certified to be in accordance with NFPA 70 and the following:

2.12.1 Installed Equipment Load

Should equipment differ from that specified, be approved for use and such equipment have different load requirements from that specified, the Contractor shall provide electrical service compatible with the installed equipment loads.

2.12.2 Electrical Fittings and Components

Food service equipment furnished under this section shall have loads, voltages, and phases compatible with building system, and shall conform to existing equipment requirements.

2.12.3 Cords and Caps

Food service equipment cord/caps shall be coordinated with related receptacles. All 120/208 volt "plug-in" equipment shall have Type SO or SJO cord and a plug with ground, fastened to frame/body of item. Mobile equipment shall have a strain-relief assembly at the cord connection of the appliance. Mobile electrical support equipment (heated cabinets, dish carts, etc.) and counter appliances mounted on mobile stands (mixers, food cutter, toaster, coffee makers, microwave ovens, etc.) shall have cord/cap assembly with cord-hanger strap secured to rear of equipment.

2.12.4 Switches and Controls

Each motor-driven appliance or electrically-heated unit shall be equipped with control switch or starter per Underwriters Laboratories, and shall have low-voltage and overload protection. Equipment or devices at 208 volts shall have integral, prewired step-down transformer to provide 120 volt control circuit.

2.12.5 Motors

Motors at 120 volts shall have manual tumbler type starter with thermal overload protection and interchangeable heating elements. Motors at 208 volts shall have magnetic starter with low-voltage protection and one interchangeable overload relay per phase.

2.12.6 Heating Elements

Electrically-heated equipment shall have thermostatic controls. Water heating equipment shall be equipped with a positive low-water shut-off.

2.12.7 Receptacles and Switches

Receptacles which are located in closed base fixtures shall be prewired to a to a junction box located within 150 mm from the bottom of the utility compartment. Receptacles which are installed in/on fabricated equipment shall be horizontally-mounted in a metal box with a stainless steel cover plate.

2.12.8 Light Fixtures

Light fixtures with lamps which are installed in/on fabricated or field-assembled equipment shall be prewired to a junction box for final connection (fixtures shall be continuous run when indicated). Fluorescent display light shall be installed the full-length of the display stand and serving shelf with stud bolts and shall be prewired through a support post to a recess-mounted switch. Heat lamps shall be installed to underside of serving shelf assemblies as specified. When multiple 600 mm heat lamps are specified, a maximum length heat lamps chassis shall be provided. Switches shall be installed remote from lamps. Cold storage light fixtures shall be electrically connected through the hub fitting located on the top of the fixture. All horizontal conduit shall be above the ceiling panels. Plastic sleeves shall be installed through ceiling panels for electrical conduit and the penetrations shall be sealed airtight at both sides of panel.

2.12.9 Final Electrical Connection Provisions

Final electrical connection points of equipment shall be tagged with item number, name of devices on the circuit, total electrical load, voltage, and phase. Fabricated equipment containing electrically-operated components or fittings, indicated on utility connections drawings to be direct-connected, shall have each component, fitting or group thereof prewired to a junction box for final connection. Refer to the drawings for circuit loading. Field-assembled equipment (example, prefabricated cold storage assemblies, conveyor systems, exhaust hoods) shall have electrical components completely interconnected by this section for final connection as indicated on utility connection drawing. The following groups of cold storage assembly electrical devices shall be prewired to a top-

mounted junction box for final connection per compartment grouping, unless otherwise indicated.

a. Light fixtures, switches, and heated pressure-relief vent.
b. Door/jamb heater and temperature monitors/alarms.
c. Evaporator fans, defrost elements, freezer fan door switch, and drain line heaters.

2.12.10 Lamps

Food service equipment containing light fixtures shall have appliance type bulbs. Exposed fluorescent lamps above or within a food zone shall have plastic coated lamps or standard lamps, sleeved in plastic tube with end caps.

2.13 PLUMBING WORK

Plumbing final connection points of equipment shall be tagged, indicating item number, name of devices or components, and type of utility (water, steam, drain).

2.13.1 Plumbing Connection Provisions

Extensions of indirect waste fittings shall be provided to open-sight hub drain, floor sink or floor drains from food service equipment. Drains shall have diameter as required, or 25 mm minimum, stainless steel. All drain lines subject to condensation shall have 25 mm thick fiberglass insulation 48 kg per cubic meter density with factory-applied fire retardant jacket and vapor barrier and shall be wrapped with 1.0 mm (20-gauge) stainless steel. Fabricated equipment containing components, fitting and/or devices indicated on food service connections drawings to be connected to the building systems shall have each component, fitting, or group thereof prepiped to a utility compartment for final connection. Piping brackets and supports shall be provided beneath/within fabricated equipment. Field assembled equipment (for example, prefabricated walk-in refrigerator/freezers, conveyor systems, exhaust hoods, dishwashing machines, convection ovens) shall have plumbing components completely interconnected under this section for final connection as indicated on utility connection drawings.

2.13.2 Exposed Plumbing

All exposed plumbing in Dining Facility Kitchen, Carryout, and Serving areas shall be stainless steel or chrome finish.

PART 3 EXECUTION

3.1 INSTALLATION

Equipment shall be installed at locations shown in accordance with NSF-02 and in accordance with the manufacturer's written instructions. The Contractor shall make provision for the plumbing, heating, and electrical connections and for equipment indicated as being furnished and installed by the Government.

3.1.1 Equipment Connections

Equipment connections shall be complete for all utilities. Unless otherwise specified, exposed piping shall be chromium-plated copper alloy. Steam operating pressure shall be as indicated.

3.2 TESTING

All equipment shall be inspected and tested under operating conditions after installation. If inspection or test shows defects, such defects shall be corrected, and inspection and test shall be repeated. Refrigerator tests shall include the following:

3.2.1 Performance Tests

A written test procedure shall be submitted for approval prior to performance of tests. The Contractor shall furnish

all instruments, test equipment, and personnel required for the tests; Government will furnish the necessary water and electricity for the installed equipment. Evidence shall be submitted that the instruments have been properly calibrated by an independent laboratory at the Contractor's expense.

3.2.2 Operating Tests

An operating test shall be performed on all items after complete installation and adjustment. The item of test failure shall be corrected and the test shall be rerun.

3.2.3 Clean and Adjust

All debris resulting from this work, as the installation progresses, shall be cleaned up and removed from the jobsite. All food service equipment, prior to demonstration, shall be thoroughly cleaned and polished, both interior/exterior. Drawer slides and casters shall be lubricated and adjusted. All pressure regulating valves, timed-delay relays, thermostatic controls, temperature sensors, and exhaust hood grilles shall be adjusted, as required, for proper operation. All faucet aerators and line strainers shall be cleaned or replaced. Damage to painted finishes shall be touched up.

3.2.4 Equipment Start-Up/Demonstration

The Contractor shall obtain the services of the manufacturer's representative experienced in the installation, adjustment and operation of the equipment specified. The representative shall supervise the start-up, adjustment, and testing of the equipment, prior to the demonstration. Equipment shall be carefully tested, adjusted, and regulated in accordance with the manufacturer's instructions and shall be so certified in writing to the Contracting Officer. A thorough operational demonstration shall be provided of all equipment and instructions furnished for general and specific care and maintenance. Selected items of equipment and attendees shall be scheduled, with the Contracting Officer, at least 2 weeks in advance of demonstration periods.

PART 4 EQUIPMENT SPECIFICATIONS

4.1 GENERAL

The items listed on the contract drawings under the heading "Food Service Equipment Schedule" shall be provided in strict accordance with the foregoing specification requirements and with the following detailed item specifications. Also included as a part of these specification requirements is the "Schedule of Standard Details" which accompanies this Section, and follows the "Equipment Specifications". Field verify all equipment dimensions.

4.2 SCHEDULE OF FOOD SERVICE EQUIPMENT

ITEM	DESCRIPTION
1	RECEIVING SCALE ON MOBILE STAND: Government Furnished, Government Installed.
2	RECEIVING DESK: Government Furnished, Government Installed.
3	GREASE CART AND HOLDING TANK, INTERIOR Contractor Furnished, Contractor Installed. Grease cart and tank shall meet N.S.F. requirements. Grease holding tank shall be a 170 gallon insulated stainless steel tank. The tank heater shall come on automatically when the grease content reaches 151 liters or more and hold temperature of grease at 44 degrees C. A warning light shall signal a need for service when the grease content reaches 540 liters. The pump shall operate on a five minute time switch. When the tank is filled to capacity, the pump shall automatically shut off so the tank cannot be

over filled. Wheeled grease cart shall be 60 liters capacity. Specifications are based on a Mavron, Inc. Model #G170 unit.

4 HAND TRUCKS:
Government Furnished, Government Installed.

5 SHELVING:
Government Furnished, Government Installed.

6 FREEZER EVAPORATOR/CONDENSING UNIT:
Contractor Furnished, Contractor Installed.

The freezer compartment refrigeration system shall be a pre-assembled remote split system with air-cooled direct expansion components. The evaporator shall be mounted at the ceiling of the freezer compartment, centered on the back wall, and the condensing unit shall be mounted on a concrete pad on grade outside the building. The entire refrigeration system shall be designed by the manufacturer to meet the design condition of 38°C ambient air and -23° indoor temperature taking into consideration the altitude at the place of installation.

The freezer shall have an evaporator with (3) 1/20 HP motors operating at 208-60-1 phase and drawing 2.7 amps. The units hall have an automatic electric defrost cycle which draws no more than 13.3 amps. The air cooled condensing unit shall have a 2.2 K.W. (3 HP) semi-hermetic compressor operating on R-404A refrigerant. Condensing unit shall be wired 208-60-3 phase and draw 11.5 full load amps. The evaporator shall be connected to the condensing unit and shall be controlled by the control circuit and timer in the condensing unit.

Furnished with the system shall be a liquid line dryer,liquid line solenoid, expansion valve, suction and discharge vibration arrestors, a timer for electric defrosts, a moisture liquid indicator, suction line filter, a room thermostat, pre-wired control panel and high and low pressure control.

Evaporator shall be ceiling hung by 13 mm nylon bolts with stainless steel washers and nuts. Hanger bolts shall be inserted through plastic sleeves with the penetrations sealed airtight.

All refrigeration lines shall be extended from the condensing unit to the evaporator, and insulated after the system has been thoroughly checked for refrigerant leaks. The insulation shall be continuous for the full length of all copper lines. The refrigeration lines shall be supported approximately every 2500 mm and at all turns. The copper refrigeration lines shall be isolated from the metal hangers. All joints in the insulation shall be sealed with insulation sealer. All insulated refrigeration piping located outdoors and exposed shall be covered completely with plastic sleeving secured and sealed in place.

Any penetration of the insulated panels for electrical wiring and conduit, refrigeration lines, drain lines and/or other services shall be made through vapor tight sleeves that pass completely through the panels and are sealed to the exterior and interior metal surfaces to prevent the infiltration of air into the insulated cavity. Interior of all sleeves shall be filled with suitable low temperature caulking. The interior of all electrical conduit shall also be sealed.

Provide a type L copper, 25 mm condensate drain line from the evaporator drain pan to outside the freezer and discharge into a floor drain. Bottom of drain pan shall have a cast tee fitting with union and cleanout plug. Drain line shall be pitched 42 mm per meter for the full length and the end of the drain line above the floor drain shall have a

"P" trap. Wrap the freezer drain line with electric heat tape and cover with 13 mm fiberglass pipe insulation.

Condensing unit shall be supplied with a stainless steel weatherproof outdoor housing, crankcase heater, and low ambient temperature head pressure controls. Condensing unit shall have an oil separator which shall be piped to compressor crankcase with a shut-off valve in return line. Condensing unit shall have a 300 mm x 50 mm engraved phenolic plastic identification sign in Contracting Officer's selection of color with 25 mm letters. Freezer compartment shall be complete with all the above specified equipment including refrigerant and all additional refrigeration equipment and accessories required to make a complete refrigeration system. System shall be installed in accordance with Section 2.13.1 of these specifications. The refrigeration system shall be completely installed as indicated on the plans with the electrical contractor connecting condensing unit, evaporator, solenoid, contactors, controls, lights, door heaters, threshold heaters, room thermostat and all component parts. Unit shall be charged and adjusted and after the initial start-up and adjustment, the installing contractor shall furnish a one year refrigeration service policy on a local level including all labor, material, refrigerant and mileage. Specifications are based on a W.A. Brown and Sons Model #LSF120B evaporator and a Model #BOPS300L6 condensing unit.

7 REFRIGERATOR EVAPORATOR/CONDENSING UNITS:

Contractor Furnished, Contractor Installed.

The three refrigerator compartments shall each have a separate refrigeration system consisting of a pre-assembled remote split system with air-cooled direct expansion components. The evaporators shall be mounted at the ceiling of each refrigerator compartment, centered on the back wall, and the condensing units shall be mounted on a concrete pad on grade outside the building. The refrigeration systems shall be designed by the manufacturer to meet the design condition of 38°C ambient air and 2°indoor temperature taking into consideration the altitude at the place of installation.

Each refrigerator shall have an evaporator with (2) 1/20 HP motors operating at 120-60-1 phase and drawing 3.6 amps. The units shall have off-cycle air type defrost. The air cooled condensing units shall have a 0.75 K.W. (1 HP) semi-hermetic compressor operating on R-22 refrigerant. Condensing units shall be wired 208-60-3 phase with 6.3 minimum circuit ampacity. The evaporator and the condensing unit shall be connected to a separate electrical circuit and shall be operated by a common thermostat furnished by the manufacturer.

Furnished with each system shall be a liquid line dryer, liquid line solenoid, expansion valve, suction and discharge vibration arrestors, a moisture liquid indicator, suction line filter, a room thermostat, pre-wired control panel and high and low pressure control.

Evaporators shall be ceiling hung by 13 mm nylon bolts with stainless steel washers and nuts. Hanger bolts shall be inserted through plastic sleeves with the penetrations sealed airtight.

All refrigeration lines shall be extended from the condensing units to the evaporators, and insulated after the systems have been thoroughly checked for refrigerant leaks. The insulation shall be continuous for the full length of all copper lines. The refrigeration lines shall be supported approximately every 2500 mm and at all turns. The copper refrigeration lines shall be isolated from the metal hangers. All joints in the insulation shall be sealed with insulation sealer. All insulated refrigeration piping located outdoors and exposed shall be covered completely with plastic sleeving secured and sealed in place.

Any penetration of the insulated panels for electrical wiring and conduit, refrigeration

lines, drain lines and/or other services shall be made through vapor tight sleeves that pass completely through the panels and are sealed to the exterior and interior metal surfaces to prevent the infiltration of air into the insulated cavity. Interior of all sleeves shall be filled with suitable low temperature caulking. The interior of all electrical conduit shall also be sealed.

Provide type L copper, 25 mm condensate drain lines from the evaporator drain pans to outside the refrigerators and discharge into a floor drain. Bottom of drain pan shall have a cast tee fitting with union and cleanout plug. Drain line shall be pitched 42 mm per meter for the full length and the end of the drain line above the floor drain shall have a "P" trap.

Each condensing unit shall be supplied with a stainless steel weatherproof outdoor housing, crankcase heater, and low ambient temperature head pressure controls. Each condensing unit shall have a 300 mm x 50 mm engraved phenolic plastic identification sign in Contracting Officer's selection of color with 25 mm letters. Each compartment shall be complete with all the above specified equipment including refrigerant and all additional refrigeration equipment and accessories required to make a complete refrigeration system. Systems shall be installed in accordance with Section 2.13.1 of these specifications. The refrigeration systems shall be completely installed as indicated on the plans with the electrical contractor connecting condensing units, evaporators, solenoids, contactors, controls, lights, door heaters, threshold heaters, room thermostats and all component parts. Units shall be charged and adjusted and after the initial start-up and adjustment, the installing contractor shall furnish a one year refrigeration service policy on a local level including all labor, material, refrigerant and mileage. Specifications are based on W.A. Brown and Sons Model #LSC090A-1 evaporators and Model #BOPS100M23 condensing units.

8 DOORWAY CLOSURES:

Contractor Furnished, Contractor Installed.

Four only doorway closures shall be installed on the interior of the walk-in door openings (Item #10) as shown on the plan. Each doorway closure shall consist of 2 mm thick clear plastic strips with rounded edges and with nylon cord reinforcement. Strips shall be USDA approved for food contact and shall withstand temperatures from -40°C to +65°C. Strips shall be 203 mm wide with a 50 mm overlap. Strips shall have an electronically heat sealed loop at the top and shall be installed on a 25 mm diameter aluminum bar mounted above the door opening on aluminum support brackets. The individual strips shall be easily removed for cleaning or replacement. Specifications are based on Curtron Model #M200-47108.

9 FAUCET HOSE STATIONS:

Contractor Furnished, Contractor Installed.

Two only faucet hose stations shall each consist of a hot and cold water washdown station with thermometer, mixing valve, 7620 mm hose, water gun and hose rack. Mixing valve shall be heavy duty chrome plated cast bronze construction with renewable disc, nickel alloy seats, integral check valve and cast bronze unions. Mixing valve shall have 20 mm inlets, 152 mm on center and a brass thermometer tee with a stainless steel thermometer with a range of 10° to 260°C. Atmospheric backflow preventers shall be provided for protection against both back siphonage and backflow. Hot water inlet shall be connected from the outlet of the Booster Heater, Item #51a. Mixing valve shall have an insulated hot water handle suitably labeled "82°C Hot Water."

Hose shall be 20 mm diameter, 7620 mm long, white, oil resistant EPDM with braided high tensile synthetic textile cord, rated at 93°C temperature and 1379 kPa working pressure. Hose shall have chrome plated brass swivel couplings at both ends. Water

gun shall have a brass body with white protective rubber cover, front trigger design and 14 mm outlet orifice. Hose rack shall be constructed of stainless steel rod and shall be designed for wall mounting.

Specifications are based on T&S Brass and Bronze Works Model#B-1451-01. At each station provide a plaque for 82°C hot water that reads, "DANGER, EXTREME HOT WATER" as shown in Schedule of Standard Details at the end of this section.

10a, 10b, 10c & 10d WALK-IN FREEZER/REFRIGERATORS:

Contractor Furnished, Contractor Installed.

One only walk-in shall consist of a freezer compartment, a dairy refrigerator compartment and two vegetable refrigerator compartments. Walk-in shall be a prefabricated metal clad polyurethane insulated walk-in in the size, shape and arrangement as shown on the plan measuring overall approximately 10650 mm wide x 4787 mm deep x 2641 mm high. Walk-in shall be floorless and shall be mounted to the insulated building floor by means of 41 mm high PVC floor screeds. Floor screeds shall be secured and sealed to the building floor.

This walk-in shall be constructed in accordance with the Underwriters Laboratories and the National Sanitation Foundation standards and shall bear their seals. Walk-in shall be built with 102 mm thick prefabricated sections. Panels shall consist of precision roll formed inner and outer metal pans separated by foamed-in-place rigid urethane insulation. Panels shall have foamed-in-place double tongue and groove edges which are the same density as the rest of the panel. Panels shall have flexible vinyl gaskets on the interior and exterior perimeter of each panel. Panel edges shall have a minimum of three cam type locking assemblies foamed-in-place at time of fabrication. Cam locks shall be actuated from the interior of the walk-in and the wrench holes shall be furnished with stainless steel plugs. Each panel shall be completely filled with foamed-in-place urethane insulation and shall be tested for voids before leaving the factory. Insulation shall have a flame spread rating of 25 or less in accordance with ASTM E-84 and shall be certified with a UL label. The "K" factor shall be 0.121, the "U" factor shall not exceed 0.030 and the "R" factor shall be 33.3.

The interior walls and ceiling, and the exposed exterior walls shall be 22 gauge type 304 stainless steel with #4 finish. All unexposed exterior walls and exterior top shall be 24 gauge galvanized steel.

Each walk-in compartment shall be provided with a flush entrance door located and hinged as shown on drawing. Each door opening shall measure 914 mm wide x 2134 mm high with both the interior and exterior of door fully covered with 22 gauge stainless steel with a #4 finish. Doors shall be fully insulated with 102 mm thick urethane foam. All door hardware shall be heavy duty type in brushed chrome finish with door to have three cam lift hinges, latch with keyed cylinder lock, padlock capability, and inside safety release. Doors shall be fitted with a 355 mm x 355 mm triple pane view port with heated glass and frame. Doors shall be equipped with magnetic gaskets and positive door closer. Door hinges and closers shall be suitable for the size of the door. Door jambs shall be equipped with perimeter anti-condensation heaters. Door jambs shall be fabricated with fiberglass reinforced plastic for high impact strength. The bottom of each door shall be equipped with special double sweep gaskets that seal the bottom of the door to the floor. Heater wires shall be provided below a 12 gauge stainless steel threshold plate below the entrance door. Threshold plates shall be flush mounted and sealed to the building floor in a concealed manner. The front of each door, above the view port, shall have a 300 mm x 50 mm engraved phenolic plastic identification sign in Contracting Officer's selection of color with 25 mm letters. Each door section shall be fitted with a recessed 64 mm dial thermometer.

Each door section shall have an incandescent light fixture with a light switch and pilot light mounted on the exterior door jamb below the thermometer. Each compartment shall be furnished with additional ceiling mounted light fixtures in quantities sufficient to achieve 22 watts per square meter of even light on the interior.

Each light fixture shall be furnished with a 100 watt incandescent light bulb and a coated glass shatterproof globe. The ceiling mounted light fixtures shall be field wired with the conduit and wiring extended on the top exterior of the walk-in and connected to thru-ceiling junction boxes. The interior and exterior of all electrical conduit and penetrations through the walk-in panels shall be sealed.

Provide and install matching 22 gauge stainless steel trim strips to close the gap between the walk-in and the building walls. Trim strips shall extend from the floor to the finished ceiling and shall be mounted and sealed to the building walls and walk-in walls in a concealed manner. Walk-in shall also be supplied with a fixed 22 gauge stainless steel closure channel extending from the top of the walk-in to the building ceiling on the exposed front as required. Mounted to the walk-in wall along the front between the door openings shall be a continuous 16 gauge stainless steel hat channel bumper rail. The bumper rail shall be mounted 500 mm above the finished floor in a concealed manner. The ends of the bumper rail shall be welded closed.

Contractor shall erect this walk-in in place carefully sealing it to the building floor with non-hardening caulking compound all in accordance with the manufacturer's recommendations. These specifications are based on a W.A. Brown and Sons walk-in.

11 AIR CURTAINS:

Contractor Furnished, Contractor Installed.

Five only air curtains shall each be a wall mounted commercial type unheated unit measuring overall 1829 mm x 324 mm x 375 mm high. Air curtains shall have a one piece molded high density polycarbonate housing in white, gray, gold, beige or dark bronze finish. Color shall match hollow metal door frame. Vertical face of housing shall have air intake louvers which shall be adjustable to reduce the air velocity up to 60% with the louvers completely closed. Bottom of housing shall have a wedge shaped discharge nozzle with two adjustable air direction vanes with a 40° sweep from front to back. Air curtain shall discharge 1,600 L/s with a maximum velocity of 11.5 M/s.

Each air curtain shall have two 0.37 K.W. continuous duty totally enclosed motors with sealed lubricated ball bearings and resilient mounts. Motors shall be connected to direct drive double width and double inlet squirrel cage blower wheels with fan housings. Air curtains shall be wired 120-60-1 and shall have the electrical junction box on the end nearest the electrical rough-in in the wall. Specifications are based on Mars Model #72C air curtains.

12 FLOOR TROUGHS WITH GRATES:

Contractor Furnished, Contractor Installed.

Two only floor troughs with grates shall be 381 mm wide x 50 mm deep and shall extend the full length of the two curbed areas as shown on plan. Each drain trough shall be constructed of 14 gauge, type 304, 18-8 stainless steel polished to a #4 finish. The drain troughs shall have coved corners and all joints and seams shall be integrally welded, ground and polished. Drain troughs shall have an integral flange around the perimeter and an integral support ledge for the grate at the front and rear. The drain troughs shall be set into the floor with the flange and grate flush with the surrounding floor level. Each drain trough shall have a 76 mm waste connection and shall be complete with an integral stainless steel sump drain with removable stainless steel sediment basket. The full length of each drain trough shall be furnished with 508 mm

maximum length sections of removable stainless steel subway type grate. Grate shall have 5 mm x 25 mm bearing bars running from front to rear to reduce splash. Specifications are based on IMC/Teddy Model #FT drain troughs with #SG grates.

12a CAN RACKS

Government Furnished, Government Installed.

13 DUNNAGE RACKS:

Contractor Furnished, Contractor Installed.

One only dunnage rack shall measure overall 1524 mm wide x 610 mm deep x 305 mm high. Each rack shall have a 38 mm square 16 gauge type 304 stainless steel tubular frame with four longitudinal rails and with all joints integrally welded. Each dunnage rack shall have 41 mm diameter stainless steel legs with 38 mm adjustable bullet feet. Specifications are based on John Boos & Co. Model #JB dunnage racks.

13a DUNNAGE RACKS:

Contractor Furnished, Contractor Installed.

One only dunnage rack shall measure overall 914 mm wide x 610 mm deep x 305 mm high. Each rack shall have a 38 mm square 16 gauge type 304 stainless steel tubular frame with four longitudinal rails and with all joints integrally welded. Each dunnage rack shall have 41 mm diameter stainless steel legs with 38 mm adjustable bullet feet. Specifications are based on John Boos & Co. Model #JB dunnage racks.

14 SINK, VEGETABLE PREP:

Contractor Furnished, Contractor Installed.

One only work table shall be custom fabricated in the size, shape and arrangement shown on drawing, measuring overall approximately 3680 mm long x 787 mm wide x 914 mm high to working level. All free edges of top shall be terminated in a 76 mm high x 38 mm diameter rolled rim. The rear edge of top abutting the wall shall be formed up into a 305 mm high x 64 mm thick backsplash. Front edge of back splash shall be mitered as shown in Schedule of Standard Details at the end of this section.

Welded integrally into the top at the right end shall be a sink insert measuring inside approximately 460 mm x 660 mm x 305 mm deep. Also welded into the top shall be two sink inserts measuring inside approximately 610 mm x 660 mm x 305 deep. Each sink shall be fitted with a twist handle drain with overflow. A 14 gauge stainless steel tab shall be integrally welded to the bottom of each sink to support the drain handle. Mounted to back splash and centered behind each sink shall be a faucet with goose neck spout as specified in Section 2.7.1.2.

Integrally welded into the top shall be a disposer bowl specified under Item #24.

Top shall be mounted to an open tube base. Base below the left drain board shall have a full length stainless steel undershelf. The remainder of the base shall be open to the floor with no rail bracing on the working side. Legs not connected to an undershelf or to rails in two directions shall have stainless steel flanged feet secured and sealed to the floor. Work table shall otherwise be constructed in accordance with Section 2 of these specifications.

15 WASTE PULPERS WITH TROUGH CONNECTION:

Contractor Furnished, Contractor Installed.

Two only waste pulpers shall be by the same manufacturer as the other components of

the waste system - the disposers, Item #24 and the extractor, Item #105. Each pulper shall have a capacity of 410 kg of waste per hour. Each pulper shall have a 762 mm diameter, 1092 mm high polished stainless steel tank with single feed trough connection and hinged lid with limit switch, 13 mm thick stainless steel slurry chamber, 5.6 K.W. totally enclosed fan cooled direct drive motor, internal junk box and cutting mechanism. Cutting mechanism shall consist of a stainless steel 343 mm diameter impeller and stainless steel perforated sizing ring. Each pulper shall be furnished with a 3.7 K.W. slurry pump. Pulpers shall be furnished with a valve package consisting of all valves required for proper operation (fresh water, trough flush and drain line).

Each pulper shall include a UL approved stainless steel NEMA 4 electrical control panel mounted to the wall as shown on plan. Control panels shall include all necessary electrical components prewired to a terminal strip, water level control and push button station. Each pulper shall also be furnished with dual water level control and motor operated valve with controls. Pulpers shall be wired 208-60-3 phase and shall have a total load of 50 amps. Specifications are based on Somat Model ##P-75S HT pulpers.

16 DISPLAY REFRIGERATOR:

Contractor Furnished, Contractor Installed.

Four only display refrigerators measuring 762 mm wide x 879 mm deep x 1981 mm high, 5 cubic feet with 2 shelves. Refrigerators shall be self contained air-cooled units with front & rear doors. Wiring should be 120VAC, 6.0Amp, single phase with a 1/5 h.p. compressor complete with cord & NEMA #5-20P plug. Exterior shall be stainless steel finish and interior shall have white anodized aluminum with 300 series stainless steel floor. Unit should be energy efficient and incorporate foamed in place polyurethane high density cell insulation (CFC Free). Specification based on True Model #GDM-5- PT-S.

17 TABLE:
Government Furnished, Government Installed.

18 TABLE/EQUIPMENT STAND:
Government Furnished, Government Installed.

19 TABLE/EQUIPMENT STAND, MOBILE:
Government Furnished, Government Installed.

20 STORAGE SHELVING SYSTEM:
Contractor Furnished, Contractor Installed.

One only storage shelving system shall include shelving on both sides of the dry storage room. The north side of the room shall have a fixed shelving unit at each end and mobile shelving units between, guided by overhead tracks. The south side of the room shall have fixed shelving units at each end, a fixed shelving section in the center and mobile shelving units between, guided by overhead tracks.

All fixed and mobile shelving units shall have five equally spaced shelves measuring 530 mm x 2185 mm. Shelves shall be constructed of welded type 302 or 304 stainless steel wire. Shelves shall have #9 wire ribs running front to back on 4.8 mm centers, with #6 wire support ribs located on 203 mm centers and corrugated reinforcement on all four sides. Welded into each corner shall be a stainless steel tapered collar shaped and sized to fit the post and inner tapered split sleeve. Vertical support posts shall be stainless steel and shall be 25 mm diameter with rolled circular grooves 25 mm apart along their length. Shelf shall be mounted to post by means of a 2 piece plastic split sleeve snapped around the post at the desired shelf height, with the resultant tapered

surface contacting the matching tapered collar in the shelf corner.

Each fixed section of shelving shall have stationary unit kits with the hardware necessary for connecting to the top tracks. Each fixed section shall have four 2184 mm posts which shall be secured and sealed to the floor. Spanning between the fixed shelving units shall be 6063-T6 aluminum extruded overhead track sets. Each mobile section of shelving shall have a mobile unit kit consisting of posts, casters/caster channels, donut bumpers and roller bearing assemblies to fit in the top tracks. Casters shall have a 127 mm diameter polyolefin wheel with offset stainless steel rigid horn and stainless steel prelubricated ball bearings. Shelving units shall be arranged as shown on drawing. Specifications are based on InterMetro Super Erecta shelving and Top-Track high density shelving systems.

21 TABLES WITH SINK:

Contractor Furnished, Contractor Installed.

Three only work tables shall each be the size, shape and arrangement shown on drawing, measuring overall approximately 1829 mm long x 762 mm wide x 914 mm high to working level. The top shall be constructed of 14 gauge stainless steel with all edges formed down 50 mm square. The top shall be depressed 5 mm with a 20 mm wide rim on all sides. Welded integrally into top at left end as shown on drawing shall be a sink insert measuring inside approximately 406 mm x 508 mm x 305 mm deep. Sink shall be fitted with a twist handle drain with overflow. A 14 gauge stainless steel tab shall be integrally welded to the bottom of the sink to support the drain handle. Mounted to top and centered behind sink shall be a deck mounted faucet with goose neck spout. Mounted to the underside of the top on the right side of the table shall be a deluxe drawer assembly with stainless steel front, ball bearing slides and a removable stainless steel insert measuring 508 mm x 508 mm x 127 mm deep. Mounted to the top shall be a utensil rack specified under Item #26. Top shall be mounted to an open tube base with stainless steel legs and an 18 gauge stainless steel full length undershelf. Specifications are based on an Advance Tabco Model #VSS-306 table with Model #TA-11B sink and Model #SS-2020 drawer.

22 MEAT SLICING MACHINE:

Government Furnished, Government Installed.

23 VEGETABLE PEELING MACHINE:

Contractor Furnished, Contractor Installed.

One only vegetable peeling machine shall have a capacity of 23 kg to 27 kg of potatoes peeled in 1 to 3 minutes. Peeler shall have a stainless steel cylinder with abrasive permanently bonded on interior surface of peeling hopper. Hopper shall have a gray molded plastic removable cover. Peeler shall have a quick opening removable aluminum hopper door with a positive cam type pressure lock and a cast aluminum discharge chute. The discharge chute shall overhand the rim of the adjacent sink. Bottom of hopper shall have a removable 520 mm diameter fiberglass reinforced plastic abrasive disc with the silicon-carbide abrasive permanently bonded to the disc. Peeler hopper shall have an air gap type water inlet mounted above the unit.

Peeler shall be wired 208-60-1 phase and shall have a 0.75 K.W. capacitor start induction run motor with manual reset overload protection and grease-packed ball bearings. Peeler disc shall be mounted on a stainless steel drive shaft rigidly mounted on grease-packed ball bearings. Motor shall drive the shaft by means of a multi-grip poly V-belt which shall be adjustable from outside the machine. Peeler shall have a synchronous timer adjustable from 1/2 minute to 4 minutes. The timer shall be located on the working side of the peeler.

Peeler shall be mounted on a disposer stand with stainless steel legs and four bolt-down adjustable leveling feet. Disposer stand shall be complete with a 0.93 K.W. disposer wired 208-60-1 phase. Disposer shall be constructed by the same manufacturer as the peeler. Disposer shall have a long upper housing. Stand shall have a solenoid water control valve and air gap type inlet. Specifications are based on a Hobart Model #6460-T peeler with a Model #FD3-125 disposer.

24 WASTE PULPING DISPOSERS:

Contractor Furnished, Contractor Installed.

Two only waste pulping disposers shall be by the same manufacturer as the other components of the waste system - the waste pulpers, Item #15 and the extractor, Item #105. Each disposer shall have a capacity of 182 kg of food waste per hour. Each disposer shall have a 254 mm diameter cast stainless steel impeller, three jam resistant hardened stainless steel swivel cutting blocks with tungsten carbide inserts, stainless steel undercutter blade, six ripper/shredder bars with hard face beaded edge, cast iron grind chamber with directional feed ridges, cast iron exit chamber with water injection inlet and cast alloy grind ring with dual stage grinding action. Each disposer shall have a 3.7 K.W. fan cooled motor with ball bearing construction. Disposers shall have screw type adjustable steel legs. Each disposer shall be rubber mounted to a 457 mm diameter stainless steel bowl which shall be integrally welded into the top of the vegetable prep sink, Item #14 and the pot and pan sink, Item #51 in the locations shown on the drawing. Each waste pulping disposer shall be furnished with a 3.7 K.W. slurry pump. Disposers shall be furnished with a valve package consisting of all valves required for proper operation (fresh water, bowl flush and drain lines).

Each disposer shall include a UL approved stainless steel NEMA 4 electrical control panel mounted to the wall as shown on plan. Control panels shall include all necessary electrical components prewired to a terminal strip, water level control and push button station. Disposers shall be wired 208-60-3 phase and shall have a total load of 30 amps. Specifications are based on Somat Model #D-5 disposers.

25 FOOD CUTTER:

Government Furnished, Government Installed.

26 RACKS, UTENSIL:

Contractor Furnished, Contractor Installed.

Three only utensil racks shall be mounted on the tables with sinks, Item #21 and shall be constructed by the same manufacturer. Each rack shall be a mid-mount unit installed at the right end of the top as shown on plan. Each rack shall be 1219 mmlong and the top shall be at 2134 mm above the floor. Each rack shall consist of two 41 mm diameter stainless steel posts with a pot rack mounted at the top and a utensil rack mounted below. Posts shall be closed at the top and shall extend down through the top and be secured to the undershelf below. Where the posts penetrate the table top, the top shall be die formed up tight around the posts. The pot rack and utensil rack shall be constructed of 50 mm x 5 mm stainless steel bars. The pot rack shall be a 559 mm wide rectangle with radius corners. The utensil rack shall be a straight bar extending from post to post. Each end of the pot racks and utensil racks shall have a stainless steel gusset with set screw so that they are adjustable in height. Pot racks shall be furnished with four plated pot hooks per foot and the utensil racks shall be furnished with two hooks per foot. Specifications are based on Advance Tabco Model #TA228 mid-mount units with Model #SCT-48 pot racks and Model #AUR-48 utensil racks.

27 RANGE, 2 BURNER:

Contractor Furnished, Contractor Installed.

One only range shall be a heavy duty two burner electric fired range with cabinet base, measuring overall approximately 305 mm x 965 mm x 914 mm high. Range shall have stainless steel front, sides, front top ledge and a stainless steel backguard. Range shall have two 228 mm french hot-plates. Range shall have a one piece heavy duty lift off cast iron top with two integral bowls and a large capacity removable aluminized drip pan. Base of range shall have a stainless steel hinged door with extruded aluminum handle. Range shall be mounted on one set of 150 mm high stainless steel legs with stainless steel adjustable flanged feet which shall be secured and sealed to the floor. Range shall be furnished with all standard equipment and shall otherwise be in accordance with the manufacturer's standard specifications. Specifications are based on a Hobart Model CR45.

28 PAN, FRYING AND BRAISING:

Contractor Furnished, Contractor Installed.

Two only braising pans shall be open leg, electric heated, manual tilting units each measuring overall approximately 1498 mm x 947 mm x 1022 mm high to the rim of the pan. Braising pan shall have a one piece all welded type 316 stainless steel pan body and clad cooking surface. Braising pan shall have interior dimensions of 1041 mm wide x 638 mm front to back x 229 mm deep and shall have a capacity of 151 liters. The pan shall have a type 316 stainless steel 38 mm draw-off valve at the left front corner. The braising pan shall have an insulated pan body with stainless steel exterior.

Pan shall have a thermostat adjustable from 93° to 204°C and a high limit safety thermostat.

The braising pan shall have a 16 gauge type 304 stainless steel hinged cover with actuator assist and with a 25 mm diameter full length stainless steel handle. Cover shall have a vent and a condensate drip shield. The pan shall pivot on a center trunion and shall have a self-locking worm gear tilt mechanism. Controls and tilt mechanism shall be located in stainless steel housings on each side of the pan body. Braising pan shall be mounted on a type 304 stainless steel, 16 gauge, 50 mm tubular support frame with adjustable bullet feet. The rear of the left console shall have a hot and cold water fill faucet. The braising pan shall be wired 120-60-1 phase and shall be furnished with an 1829 mm long electrical cord and plug. The entire braising pan shall be U.L., N.S.F. and A.G.A. approved and listed. Specifications are based on a Groen Model FPC/1 braising pan. Water for the braising pan shall also be provided by a water metering device, Item #45.

29 REFRIGERATOR, RAPID THAW, ROLL-IN:

Contractor Furnished, Contractor Installed.

One only thaw refrigerator shall be a two section roll-in unit with full height solid doors hinged as shown on drawing. This rapid thaw, roll-in refrigerator shall be by the same manufacturer as all other roll-in refrigerators in the project. Each door shall have a clear opening of 700 mm x 1730 mm. The refrigerator shall have a stainless steel interior and exterior with a #4 finish. Refrigerator shall also be furnished with a stainless steel rear panel extending the full width and height. The front frame shall be extruded thermal plastic providing a thermal break between the interior and exterior of the cabinet eliminating the need for anti-condensate heaters. No heater wires are acceptable. The interior liner shall be crimped construction with 9.5 mm radius bends for easy cleaning. The refrigerator shall have 50 mm minimum (non-CFC) polyurethane foam insulation poured, expanded, and bonded in place completely filling all cavities between the inner and outer surfaces of cabinet and doors. The door handles shall be heavy duty cast aluminum bumper type positioned horizontally with cylinder lock. Doors shall be furnished with single or double padlock posts and plates as required. Door hinge mechanisms shall be spring loaded cam lift design concealed

within the door. Hinges shall be furnished with stops and shall be mounted to reveal full door opening when door is opened past 90 degrees. All doors must be field rehingeable without drilling or defacing the cabinet. Doors shall have interior door panels made of one piece ABS thermoplastic. The vinyl door gaskets shall be easily replaceable without the use of tools. The refrigerator shall have an exterior digital thermometer. The interior light shall be controlled by a door actuated switch. The light bulb should be covered with a shatterproof cover.

Refrigerator shall have a 25 mm thick insulated floor with 22 gauge stainless steel finish. Each door shall have a stainless steel ramp which shall be sealed to the floor.

Refrigerator shall be self-contained with a top mounted compressor wired 120-60-1 phase and complete with an electrical cord and plug. Refrigerator shall have a high starting torque 0.37 K.W. compressor rated at 4,560 BTU at 32°C ambient temperature. The refrigeration system shall be complete with condensing fan and fan motor, removable insulated coil housing, and temperature control. The R22 refrigerant shall be metered through a capillary tube. No expansion valves shall be accepted. The evaporator shall be balanced with the compressor rating and shall maintain 2°C cabinet temperature. Cabinet air shall be distributed by a multi-louvered duct from the evaporator into the cabinet. Defrosting shall be automatic. The condensate water shall be automatically evaporated from the top of the cabinet. No energy consuming heaters or electrically operated devices are acceptable. No plumbing connections shall be required.

Refrigerator shall be furnished with a safety thawing system designed to automatically thaw frozen product through use of the refrigeration system in a reversed, heat pump mode. Resistance heaters are not required. The unit shall have two mullion mounted fan assemblies to aid the thawing process. The unit shall automatically revert to a 3° to 5°C holding cabinet after the thawing process is completed.

The refrigerator shall be furnished with a one year refrigeration service policy on a local level. Specifications are based on a Victory Model TRIS-2D-S6 roll-in refrigerator with safety thaw option.

Furnished with the thaw refrigerator shall be two roll-in universal angle racks sized to fit the refrigerator. Each rack shall measure 670 mm x 685 mm x 1640 mm high and shall be furnished with 12 pairs of universal angle slides. Top and bottom slides shall be welded to the rack frame. The remaining sets of slides shall be adjustable on 38 mm centers. Each set of slides shall hold (1) 460 mm x 660 mm pan or (2) 305 mm x 510 mm pans and all pans shall be supported on the bottom of the pan. The rack frame shall be constructed of all welded aluminum channels and a solid one piece base plate. Racks shall be mounted on swivel casters with brakes and 125 mm diameter x 30 mm wide neoprene tires. Each rack shall have a foot actuated floor lock. Specifications are based on Cres-Cor Model #207-UA-12C racks.

30 FLOOR TROUGHS WITH GRATES:
Contractor Furnished, Contractor Installed.

Three only floor troughs with grates shall be 762 mm x 762 mm x 50 mm deep and shall be located as shown on plan. Floor troughs and grates shall otherwise be the same as those specified for Item #12.

31 FROZEN FOOD CABINET (PASS-THRU):
Contractor Furnished, Contractor Installed.

One only pass-thru freezer shall be a two section unit with 48.9 cubic feet capacity and constructed by the same manufacturer as Item #29. Freezer shall be fitted with full

height doors, on both sides of cabinet, hinged as shown on plan. The freezer shall have a stainless steel interior and exterior. The front frame shall be extruded thermal plastic providing a thermal break between the interior and exterior of the cabinet with anti-condensate heaters. The interior liner shall be crimped construction with 10 mm radius bends for easy cleaning. The freezer shall have non CFC polyurethane foam insulation poured, expanded, and bonded in place completely filling all cavities between the inner and outer surfaces of cabinet and doors. The doors shall have heavy duty, cast aluminum, bumper type door handles positioned horizontally with cylinder lock and keys. Chrome plated door hinge mechanisms shall be spring loaded, cam lift design furnished with stops and mounted to reveal full door opening when door is opened past 90 degrees. All doors must be field rehingeable without drilling or defacing the cabinet. Doors shall have single or double padlock posts and plates as required. Doors shall have interior door panels made of one piece ABS thermoplastic. The interior light shall be controlled by a door actuated switch. The vinyl door gaskets shall be easily replaceable without the tools. The freezer shall have an exterior digital thermometer. The freezer shall have 152 mm high stainless steel legs with stainless steel adjustable feet.

The freezer shall be self-contained with a top mounted compressor wired 120-60-1 phase with 3048 mm cord and plug. The refrigeration system shall be complete with condensing fan and fan motor, removable insulated coil housing, and temperature control. Defrosting shall be automatic with a defrost clock for time actuation and termination. The defrost heaters shall have safety overload protector. The refrigerant shall be metered through a capillary tube. No expansion valves shall be accepted. The refrigerator shall have a high starting torque 5.6 K.W. compressor rated at 3,380 BTU at 32°C ambient temperature. The refrigeration system shall use R404A refrigerant. The evaporator shall be oversized to operate at -23°C temperature. The condenser shall have a heavy duty one piece all aluminum skived fin design to match the motor-compressor rating. No plumbing connections shall be required. The condensate water shall be automatically evaporated from the top of the cabinet. No energy consuming heaters or electrically operated devices are acceptable. The freezer shall be furnished with a one year refrigeration service policy on a local level.

Freezer shall be equipped with ten only stainless steel wire shelves. Shelves shall be adjustable on 25 mm centers. Specifications are based on a Hobart Model #QSDF-2 frozen food cabinet.

32 OVENS:

Contractor Furnished, Contractor Installed.

Three only convection ovens shall each be a double deck electric fired baking and roasting oven. The overall dimensions shall be 1013 mm wide x 902 mm deep x 1581 mm high, including a 178 mm high stainless steel leg stand with adjustable stainless steel feet. Exterior front, top, and each end shall be stainless steel. Interior of each deck shall be stainless steel. Oven interiors shall measure 737 mm wide x 695 mm deep x 508 mm high. Each oven shall be insulated with high temperature glass fiber sheets with 50 mm thickness on the doors, back and sides and 102 mm thickness on top. A single handle mounted on left hand door shall operate both doors simultaneously to the side with a 180 degree total opening angle. Doors shall have multi-pane windows. The interior of each oven shall be fitted with removable chrome plated rack supports with a capacity of eleven racks. Each oven deck shall be furnished with five only chrome plated wire racks.

Ovens shall preheat to 204°C within 15 minutes. Each oven shall have a 0.25 K.W. two speed thermally protected fan motor, wired 120-60-1 phase and rated at 5.6 amps. Each oven shall have two 2134 mm long electrical cords and plugs.

Each oven shall have interior oven lights and auxiliary fan switch for rapid cool down with the doors open. Fan motor shall shut off when oven doors are opened. Oven controls shall be side mounted with a thermostat adjustable from 90° to 260°C. Timers shall be electrical 5 hour type with continuous sounding buzzer. Each lower oven compartment shall be a "Roast and Hold" deck with two speed fan, 12 hour timer, preset holding thermostat and "Roast and Hold" selector switch. Oven shall be AGA design certified, NSF listed and CGA approved. Specifications are based on Vulcan Model ET-88R (33 KW) double deck ovens.

33 OPENER, CAN:

Government Furnished, Government Installed.

34 MIXING MACHINE:

Contractor Furnished, Contractor Installed.

One only mixer shall be a 57 liter capacity floor type mixer by the same manufacturer as all other mixers on the project. Mixer shall have a 1.5 K.W. motor built by the mixer manufacturer and designed especially for this mixer. The motor shall have grease-packed ball bearings and a ventilated splashproof enclosure. Mixer shall be wired 208-60-3 phase and shall be U.L. listed. The mixer shall have a magnetic contactor with automatic resetting bimetallic thermal overload protection internally mounted. Mixer shall be fitted with a start-stop button protected by rubber caps and a 15 minute motor driven timer. Mixer shall have a reduced voltage pilot circuit transformer for the controls. Mixer shall have a direct drive transmission with constant mesh helical gears of hardened alloy steel. A hardened steel worm and alloy bronze worm wheel shall transmit power from the motor to transmission. Circulating oil lubrication shall be furnished to all gears. Mixer shall have a glass visual type oil level gauge. No belts, pulleys, or chains shall be acceptable. No periodical internal lubrication shall be required. Mixer shall have four fixed agitator speeds, with speed #1 at 70 RPM, speed #2 at 124 RPM, speed #3 at 206 RPM, and speed #4 at 362 RPM. Mixer shall be equipped with a #12 tapered attachment hub mounted on the front. Mixer shall be supplied in a metallic gray polyurethane enamel finish. The bowl lift on the mixer shall be hand-cranking, self-locking and shall be adjustable to assure proper agitator and bowl clearance.

Supplied with this mixer shall be:
One only 56 liter stainless steel bowl.
One only 56 liter flat beater.
One only 56 liter stainless steel wire whip.
One only 56 liter dough hook.
One only 56 liter bowl scraper.
One only 56 liter bowl truck.

Mixer shall be supplied with a one year warranty on parts, labor and mileage against manufacturer's defects. Mixer shall also be listed by National Sanitation Foundation and shall be certified by the Baking Industry Sanitation Standards Committee. Specifications are based on a Hobart Model #H600T.

35 MIXING MACHINE:

Government Furnished, Government Installed.

36 KETTLE:

Contractor Furnished, Contractor Installed.

One only kettle shall be a electric fired, fully steam jacketed, stationary tri-leg kettle with a capacity of 152 liters. Kettle shall measure overall 1140 mm wide x 1040 mm deep x 1020 mm high to top of rim. The interior bottom of the kettle shall be dish-

shaped and shall slope toward the front to a 76 mm diameter tapered plug type draw-off valve. Kettle shall have stainless steel interior and exterior and shall be mounted on three 50 mm diameter stainless steel legs with adjustable bullet feet. Kettle shall have a stainless steel dome-shaped cover hinged on the left, with drop type handle and insulated knob. The stainless steel control panel shall be located on the right. Unit shall be equipped with a hot and cold water faucet with swing spout and bracket mounted on the kettle.

Kettle shall be factory charged with chemically pure water, rust inhibitor and antifreeze set to -34°C. Kettle shall be NSF listed, AGA design certified and constructed per ASME code. Specifications are based on a Vulcan Model #EL40D.

37 PIZZA WARMER:

Two only pizza display/warmers to measure 460 mm wide x 510 mm deep x 890 mm high wired for 120V, 60Hz, 12 Amps with NEMA 5-15P plug. The stainless steel display cabinet has tempered glass sides with front & rear door access and an internal incandescent light. The unit shall have separate heat and humidity controls with a cabinet temperature monitor. Also included should be a four shelf multi-purpose rack. Specification based on Hatco Model #FDW-2.

38 KETTLES W/STAND:

Contractor Furnished, Contractor Installed.

One only 19 liter tilting kettles shall be mounted on a stainless steel modular base with a electric fired steam generator. Kettles and stand shall measure overall 910 mm x 840 mm x 1466 mm high. Kettles shall be all welded type 304 stainless steel with a double wall steam jacket around the lower 2/3 of the kettle. Kettles shall tilt forward 90° to completely empty and then return to a vertical position.

Cabinet base shall have stainless steel top, sides and front doors. Rear of base shall be aluminized steel. Doors shall be double pan construction with recessed pull handles. Base shall be mounted on 152 mm stainless steel legs with adjustable feet. The rear feet shall be flanged for anchoring to the floor. Base shall have a single swing spout faucet to fill both kettles. Top of base shall have recessed drain pans in front of the two kettles.

The cabinet base shall have a steam generator. Steam generator controls shall be wired 120-60-1 phase. Steam lines between generator and kettles and all steam line accessories shall be completely pre-piped on the interior of the base. The top of the stand shall have a steam control valve for each of the kettles. Specifications are based on Vulcan Model #2T-20-E3.

39 EXHAUST HOOD:

Contractor Furnished, Contractor Installed.

One only exhaust hood shall be a high velocity water wash ventilator constructed in compliance with NFPA #96, BOCA, ICBO (Uniform Mechanical Code), SSBC and ACGIH (American Conference of Governmental Industrial Hygienists). The exhaust hood shall be U.L. Listed and NSF approved. Exhaust hood shall be constructed in the size, shape, and arrangement shown on drawing and equipment schedule, measuring overall approximately 6500 mm long x 4114 mm wide x 914 mm high. Exhaust hood shall consist of two 1981 mm wide hoods mounted back to back with a 152 mm spacer between. Spacer shall be constructed of 18 gauge stainless steel and shall extend on the top, bottom and both ends of the exhaust hood. Hoods shall be centered above the 1200 mm high wall as shown on plan. Exhaust hood shall be complete with high velocity grease extractor, plenum fire-dampers, duct collars, make-up air plenum, hanger brackets, auto wash control panel, piping, and nozzles. All sections of hood shall be

pre-wired and pre-plumbed to individual connection points.

The entire exhaust hood shall be constructed of 18 gauge type # 304 stainless steel with a #4 finish. All external seams and joints shall be welded liquid tight with all exposed welds ground smooth and polished back to original finish. Exhaust hood shall be furnished with all necessary hanger rods and shall be suspended from building structure above. Hood shall be supplied with stainless steel closure channels on front and both ends as required to close the gap between the top of the exhaust hood and the finished ceiling.

Hood shall be fitted with a full length high velocity low volume grease extractor chamber with four pass design. Horizontal baffles shall extract and retain grease out of air stream prior to wash down. Full length baffle shall be hinged for easy access to piping, nozzles, and entire extraction chamber. Exhaust duct collars shall be sized as shown on the mechanical drawings.

Provide stainless steel U.L. Listed spring loaded electrically activated manually resettable fire dampers controlled by electric thermostats with 182°C fusible link back up. Both dampers and thermostats shall be mounted at duct collars and easily accessible. Should power fail, damper shall remain open to allow continued cooking and shall close only in the event of fire.

The integral tampered make-up air supply system shall consist of duct collars, plenums, air diffuser baffles and discharge registers. This supply air chamber shall have perforated panels on external face of hood for low velocity discharge of air into kitchen. Perforated panels shall be hinged. Make-up air duct collars shall be sized as shown on the mechanical drawings.

Exhaust hood shall have a 914 mm x 914 mm x 178 mm deep wash control panel with auto wash system, which when activated will automatically wash down entire extraction chamber and plenum with 60°C water and detergent. Water spray system shall also provide internal plenum and duct collar protection when activated by thermostat or manual pull fire switch. Wash control panel shall have a flange on all sides and shall be flush mounted in the opening in the wall. All conduit and piping shall be concealed in the wall.

Each section of hood shall be fitted with U.L. Listed pre-wired recessed fluorescent light fixtures extending the full length of each hood section. All light fixtures shall be wired in a concealed manner to a junction box on top of the hood for connection to the light switch mounted in the wash control panel. This hood shall otherwise be in accordance with the manufacturer's standard specifications. Specifications are based on an Avtec Model #AWWP exhaust hood.

40 CHUTE, HOT SANDWICH:

Contractor Furnished, Contractor Installed.

Two only sandwich display warmer with dual slanted shelves should measure 914 mm wide x 610 mm deep x 686 mm high and shall be wired with 120V; single phase, 7.8 Amps and have a NEMA 5-15P plug. Unit shall be constructed of extruded aluminum and stainless steel with tempered glass end panels and incandescent lights to illuminate shelves. Shelves to have hardkote finish and display sign holders. Warmer will have an electronic temperature controller and a temperature monitor. Specification is based on a Hatco Model GRSDS-36.

41 FIRE SUPPRESSION SYSTEM:

Contractor Furnished, Contractor Installed.

The exhaust hood, Item #39, shall be furnished with a liquid agent fire suppression system which shall be installed in a recessed stainless steel cabinet mounted in the wall near the ceiling as shown on plan. No conduit or piping shall be exposed to view. The fire suppression system shall be a U.L. Listed liquid agent, cartridge operated, regulated pressure system with a fixed nozzle agent distribution network. The system shall be capable of automatic detection and actuation with local or remote manual actuation. Fire suppression system shall be provided with a remote manual pull station recessed in the wall below the fire suppression system cabinet. The fire suppression system shall be factory piped and complete with all necessary surface protection nozzles as required by Code. The system shall be a multiple system with capacity properly sized for the nozzles required. The extinguishing agent shall be a potassium carbonate, potassium acetate-based formulation designed for flame knock down and securement of grease related fires. The regulated release mechanism shall be a spring loaded mechanical/pneumatic type with a nitrogen cartridge for providing the expellant gas supply to the liquid agent tanks. The regulated release mechanism shall contain a factory installed regulator set at 690 kPa The mechanism shall have a visual indicator of the cocked or fired position without having to open the enclosure. The fire suppression system shall have an automatic fusible link detection system. The fire protection system shall also have a microswitch to allow the shut-off of all gas and electricity for the items below the exhaust hood. Shut-off devices shall be furnished and installed under other sections of the specifications. All exposed piping for the fire suppression system shall be chrome plated or chrome sleeved. The fire suppression system shall be installed in accordance with the Underwriter's Laboratories Listing, NFPA 96 and NFPA 17 and shall conform to all local authorities having jurisdiction over this fire suppression system. Upon completion of the installation of the fire suppression system, a qualified fire suppression installer shall inspect the system and certify in writing that this system meets all applicable Codes. Specifications are based on an Ansul Model #R-102 system.

42 FRYER/DRAIN STATION COMBO UNIT:

Contractor Furnished, Contractor Installed.

One only fryer/drain station shall consist of two fryers with a built-in filter system on the left end. Each fryer shall have a capacity of 30.9 K.G. of oil and shall have the capacity of cooking up to 65.5 K.G. of frozen french fries or 68.2 K.G. of chicken per hour. Each fryer shall have a stainless steel fryer vessel, heat transfer tubes, splash deck, splash back and flue deflector installed in a cabinet base. Fry vessel shall have seamless corners and shall be drawn from 18 gauge stainless steel with four 18 gauge stainless steel heat transfer tubes. Fryer vessel and heat transfer tubes shall be polished to a #7 mirror finish. Splash deck shall be constructed of 18 gauge stainless steel and shall slope toward the fry vessel. It shall have 102 mm high vertical sides to prevent boil-over. Cabinet shall be constructed of 18 gauge stainless steel on sides and rear with 22 gauge stainless steel door, 22 gauge stainless steel control panel and 18 gauge stainless steel canopy.

Each fryer shall include a melt cycle for solid shortening. Fryers shall have a thermostat with stainless steel bulb, accurate to 1°C and adjustable from 120° to 190°C. Each fryer shall have a manually resettable high limit control with stainless steel bulb and a safety test switch on the control panel. Fryers shall be wired 120-60-1 phase and shall be furnished with an electrical cord and plug.

Each fryer shall be furnished with one pair chrome plated four mesh baskets, chrome plated grid screen over heat transfer tubes, drain claim out rod and sample of cleaning powder.

Fryers shall be connected to a built-in central filter system with a capacity of 35.5 K.G. of oil. Filter shall be a closed system requiring no direct contact with the shortening and

shall filter each fryer in six minutes. Filter shall have a 0.25 K.W. pump with a capacity of 0.32 L/s. Filter shall have a stainless steel cabinet and door to match the fryers and the top of filter shall have a recessed perforated stainless steel bagging station. Filter shall have a safety switch to provide 100% fryer shut-off when the drain valve is opened. Each fryer shall have a 32 mm rear drain opening with front release and a 50 mm drain line with 6% slope to the filter drawer. Each fryer shall also have a return valve with a closed pipe return system. Return valve shall be located above the drain line and must be opened before the drain valve can be opened. Base of filter shall have a stainless steel filter drawer and crumb basket, a screen, hold down ring and spring loaded "T" arms for the filter paper and filter media. Filter system shall be furnished with one carton of 60 individual packages of filtering compound and one package of 60 paper filters. Mounted to the backsplash over the filter and bagging system shall be a food warmer. Warmer shall have two 250 watt infrared bulbs, heavy duty chrome shades, bulb protectors, ceramic sockets and an 1829 mm long electrical cord and plug. Warmer shall be adjustable in height from 584 mm to 711 mm.

Fryers and filter shall be secured together in one battery with a one piece continuous front ledge and connecting stripe between each unit. Fryers and filter shall be mounted on one set of casters with polyurethane tired wheels and brakes on the front casters. Specifications are based on Keating Model #18TS fryers, Model #W0SA 18 CF filter and Model #2 LCF food warmer.

43 FRYER/DRAIN STATION W/FILTER:

Contractor Furnished, Contractor Installed.

Two only fryer/drain stations shall each consist of two fryers with a built-in filter system on one end as indicated on the plan. Each fryer shall have a capacity of 17.3 K.G. of oil and shall have the capacity of cooking up to 32.7 K.G. of frozen french fries or 34.1 K.G. of chicken per hour. Fryers shall be connected to a built-in central filter system with a capacity of 21.8 K.G. of oil. Filter shall have a food warmer mounted to the backsplash. The fryers, filters and food warmers shall have the same construction, options and accessories as specified for Item #42. Specifications are based on Pitco Frialator Model #14-SS fryers, Keating Model #WOSA 14CF filters and Model #2 LCF food warmers.

44 DISPLAY, PASTRY:

Contractor Furnished, Contractor Installed.

Two only self serve pastry displays with front serve access. Constructed of clear acrylic, unit should measure 457 mm wide x 488 mm deep x 305 mm high and be able to hold two 330 mm x 427 mm trays on two shelves. Specification based on Hubert Display Fixtures Catalog Stock #74476.

45 WATER METERS:

Contractor Furnished, Contractor Installed.

Two only water meters shall each measure overall 430 mm x 315 mm x 300 mm high. Water meters shall have an automatic hot and cold water manual mixing valve with a capacity of 90.7 K.G./minute. Water meters shall be accurate to plus or minus 1%. Water meters shall be furnished with a wall mounting bracket and shall be installed in locations shown on plan. Specifications are based on Stoppil Model #AMM.

46 TABLE, BAKERS:

Government Furnished, Government Installed.

47 COOKER STEAMER:

Contractor Furnished, Contractor Installed.

One only steamer shall be a two compartment unit mounted on a cabinet base with an electric gas fired steam generator. Steamer shall measure overall 914 mm x 838 mm x 1545 mm high. Steamer shall have automatic compartment controls to allow pressureless compartment operation during the preheat and defrost cycles. and when 82°C is reached, the automatic operation switches to 35 to 103 kPa pressurized limited free venting cooking. Cooking shall be load compensated and automatically timed. When the compartment cooking cycle ends, one minute shall be allowed for exhaust drainage before the end of cycle buzzer sounds. Steam compartment controls and generator controls shall be wired 120-60-1 phase.

Steamer compartments shall be 670 mm wide x 330 mm high x 543 mm deep and shall have stainless steel interior and exterior. Each compartment shall have removable pan slides with a capacity of (8) 305 mm x 508 mm x 64 mm pans or (6) 457 mm x 660 mm sheet pans. Compartment doors shall have a stainless steel spring loaded latch with paddle type release and a cross bar handle door screw.

Steamer compartments shall be mounted on a cabinet base with stainless steel panels on the sides and rear and hinged stainless steel doors on the front. Base shall be mounted on 152 mm high, 50 mm diameter stainless steel legs with adjustable feet. Rear feet shall be flanged for anchoring to the floor. Mounted in the base shall be a steam generator. Steam generator shall have automatic blow down with cold water condenser. Steamer shall be NSF listed, AGA design certified and constructed per ASME code. Specifications are based on Vulcan Model #VL-2E2-PS.

48 HAND SINKS (S/S):

Contractor Furnished, Contractor Installed.

Eight only hand sinks shall each have one piece deep drawn heavy gauge stainless steel construction with all vertical and horizontal corners coved. Hand sinks shall measure overall 438 mm long X 387 mm wide with a bowl size of 356 mm x 254 mm x 127 mm deep. Hand sinks shall have an integral 197 mm high backsplash with a 50 mm 2" turn back on a 45° angle. The hand sinks shall be furnished with a stainless steel skirt on the front and both sides. Hand sinks shall be installed with the front rim at 910 mm above the finished floor.

Each hand sink shall be furnished with a stainless steel paper towel dispenser designed to dispense "C" fold paper towels. Paper towel dispenser shall be mounted to the sink backsplash and shall measure 438 mm long x 102 mm wide x 498 mm high. Mounted to the front of the towel dispenser at the left end shall be a soap dispenser.

Hand sinks shall have two openings in the backsplash at 4" on center. Mounted to the backsplash shall be a standard faucet with wrist action handles and a swivel goose neck spout with aerator. Each sink shall be equipped with a 38 mm stainless steel basket drain, a lever operated drain with built-in overflow with plastic overflow tube and spring clips. Specifications are based on Advance Tabco Model #7-PS-85 sinks.

49 INGREDIENT BIN, MOBILE:

Government Furnished, Government Installed.

50 POT SANITIZER:

Contractor Furnished, Contractor Installed.

One only pot sanitizer shall be an automatic door type utensil washer with timed wash and rinse cycle and a capacity of (25) 610 mm x 711 mm racks per hour. Utensil washer shall measure overall 978 mm wide x 892 mm deep x 2551 mm high. Hood and tank shall be all welded 14 gauge type 304 stainless steel. Tank shall have a flat bottom

with stainless steel frame and legs and shall have a capacity of 114 liters. All internal castings shall be non-corrosive Ni 412 non-ferrous nickel alloy with stainless steel track construction, stainless steel scrap screens welded with no sharp edges, nylon suction strainer, brackets and supports and stainless steel power jet spray arms.

Utensil washer shall have a front inspection/cleanout door and two simultaneously opening doors. Operating doors shall be cantilevered with spring connected directly to door lever. Doors shall be die formed and shall ride in interior mounted all welded channels. Top of utensil washer shall have a 152 mm x 152 mm center vent.

Utensil washer shall have a NEMA type 12 water-tight stainless steel control box with solid state timing, automatic tank fill, automatic positive low water cutoff, door interlock, by-pass manual selector switch, and 24 volt control circuit. Wash cycle shall be adjustable from 0 to 5 minutes and rinse cycle shall be adjustable from 0 to 30 seconds. When power switches are turned on and doors closed standard sequence will automatically fill tank and turn on tank heat. Wash/rinse cycle shall be automatically actuated by closing door.

Utensil washer shall have a centrifugal type packless ball bearing pump with ceramic type seal, stainless steel parts, and a mounted balanced impeller on a precision ground shaft. Utensil washer shall have a 3.7 K.W. squirrel cage induction type motor with internal fan cooling and ball bearing construction.

Utensil washer shall have free-wheeling rotating power wash and rinse arms with two wash and two rinse arms above and two wash and two rinse arms below. Wash and rinse arms shall be easily removable without tools.

Utensil washer shall have a 5 K.W. electric immersion tank heater with positive low water cutoff. Utensil washer shall be wired 208-60-3 phase.

Utensil washer shall be furnished with one general utility rack, one basket rack, one bake sheet rack, wash and rinse thermometers, vacuum breaker, cleanout brush and hold down grid. Utensil washer shall also be furnished with a removable stainless steel front panel.

Also furnished with the utensil washer shall be a 12 K.W. electric booster heater wired 208-60-3 phase. Booster heater shall furnish sufficient 82°C to the utensil washer with 60°C incoming water.

Specifications are based on Insinger Model CA3.

50a DISH TABLE, CLEAN:

Contractor Furnished, Contractor Installed.

One only dish table shall be custom fabricated in the size, shape and arrangement as shown on drawing measuring overall approximately 1219 mm long x 914 mm wide x 864 mm high to working level. The entire top shall be constructed of one piece 14 gauge stainless steel with the front and left end edge formed up into a 76 mm high x 38 mm diameter rolled rim. The rear edge of top abutting the wall shall be formed un into a 305 mm high x 64 mm thick backsplash. Front edge of backsplash shall be mitered as shown in Schedule of Standard Details at the end of this section. Backsplash at right end shall be mitered into the utensil washer as shown on plan. The right end of top shall be formed down into the utensil washer and secured and sealed in a complete watertight manner. The entire top shall be mounted to a stainless steel open tube base with an undershelf. This dish table shall otherwise be constructed in accordance with Part 2 of these specifications.

51 SINK, POT & PAN:

Contractor Furnished, Contractor Installed.

One only pot and pan sink shall be custom fabricated in the size, shape and arrangement shown on drawing, measuring overall approximately 5625 mm wide x 825 mm deep on one leg and 561 mm wide x 825 mm deep on the other leg x 864 mm high to working level. All free edges of top shall be terminated in a 76 mm high x 38 mm diameter rolled rim. The rear edges of top abutting the wall shall be formed up into a 305 mm high x 64 mm thick backsplash. Front edge of backsplash shall be mitered as shown in Schedule of Standard Details at the end of this section.

Integrally welded into the right hand drain board shall be a disposer bowl specified under Item #24. Mounted to the backsplash behind the bowl shall be a pre-rinse faucet specified under Item #52.

Welded integrally into the top shall be three sink compartments and a sump sink as shown on plan. The three sink compartments shall each measure inside approximately 711 mm x 812 mm x 305 mm deep. Each sink shall be fitted with a twist handle drain with overflow. A 14 gauge stainless steel tab shall be integrally welded to the bottom of each sink to support the drain handle. Mounted to backsplash and centered behind the right hand sink and above the partition between the two left hand sinks shall be a faucet with goose neck spout as specified in Section 2.7.1.2.

Bottom of left sink compartment shall be fitted with a sink heater specified under Item #54. Mounted to the backsplash above the left sink compartment shall be a single faucet with 98 mm fixed spout. Faucet inlet shall be connected from the outlet of the booster heater, Item #51a. Faucet shall have a heat resistant handle to withstand 82°C water temperature. Specifications are based on a T&S Brass & Bronze Works Model #B-0700 faucet with Model #001147-45 handle with red index button. Mounted to the backsplash shall be a plaque for 82°C hot water that reads, "DANGER, EXTREME NOT WATER" as shown in Schedule of Standard Details at the end of this section.

Sump sink shall be 129 mm wide x 102 mm deep and shall be constructed in accordance with Details in Schedule of Standard Details at the end of this section. Sump sink shall have an 18 gauge stainless steel cove corner all welded perforated basket with 9.5 mm diameter stainless steel rod handles. Bottom of sump sink shall be scored and pitched to a 38 mm open drain fitting.

Top shall be mounted to a stainless steel open tube base open to the floor with no rail bracing on the working side. Legs not connected to rails in two directions shall have stainless steel flanged feet secured and sealed to the floor. Pot and pan sink shall otherwise be constructed in accordance with Section 2 of these specifications.

51a HEATER, BOOSTER:

Contractor Furnished, Contractor Installed.

Three only booster heaters shall each be an electric booster heater measuring 600 mm x 580 mm x 800 mm high including legs. Booster heaters shall have a 60 liter tank, fiberglass insulation and shall have a stainless steel front panel, body and base. One booster heater shall be located in Storage Room #106 near the can wash area. This booster heater shall be mounted on stainless steel legs, adjustable in height from 152 mm to 203 mm. The other booster heaters, which shall be mounted to the underside of the drainboard of the pot and pan sink, Item #51 and pot sanitizer Item # 50, shall be without legs and shall be mounted on angle slide brackets.

Booster heaters shall have 15.0 kilowatt elements wired 208-60-3 phase and shall have the capacity to heat 572 liters per hour of water from 60° to 82°C. Heating elements

shall be metal sheathed, controlled by close tolerance immersion thermostats. Booster heaters shall be protected with a high temperature limit switch and low water cut-off. Each booster heater shall also be furnished with temperature/pressure relief valve, pressure reducing valve, two temperature/pressure gauges, shock absorber, pilot light and on-off switch. Booster heaters shall be furnished with all standard equipment and shall otherwise be in accordance with the manufacturer's standard specifications. Specifications are based on Hatco Model #S-15.

52 SPRAY, PRE-RINSE:

Contractor Furnished, Contractor Installed.

Two only pre-rinse faucets shall be mounted to the backsplash above the disposer bowl on Item #14 and Item #51. Each shall be a backsplash mounted pre-rinse faucet complete with wall bracket. Faucet shall have 13 mm NPT female inlets spaced 203 mm on center. Faucet shall have internal check valves and shall have stainless steel seats and swiveling seat disks. Faucet shall have a 10 mm NPT female outlet with a 457 mm long vertical riser. Connected to the riser shall be a hose with a stainless steel sheath, an insulated handle, and a spray valve. Pre-rinse unit shall have a coil spring and a hook to hold the spray valve in position. Faucets shall be in accordance with the manufacturer's standard specifications. Specifications are based on a T&S Brass & Bronze Works Model #B-0133-B.

53 HOOD, EXHAUST CONDENSATE:

Contractor Furnished, Contractor Installed.

One only exhaust hood shall be a factory built wall mounted canopy style condensate ventilator. Hood shall be an exhaust only, Type II unit designed specifically for removal of moisture laden air in non-grease applications. Exhaust hood shall measure 1524 mm x 1372 mm x 610 mm high. The mounting height of the hood shall be coordinated with the clearance required to remove the doors of the pot sanitizer, Item #50. Exhaust hood shall be constructed in accordance with the latest requirements of NFPA Bulletin #96 and shall be fabricated according to the National Sanitation Foundation Standard #2 and shall bear the NSF seal. The exhaust hood shall be constructed of 18 gauge type 304 stainless steel with a #4 finish. All exposed welds shall be ground smooth and polished to the original finish of the metal. Internal seams shall be filled with NSF approved non-hardening sealer. Hood shall include a full length removable condensate baffle constructed of 18 gauge type 304 stainless steel. Baffle shall be pitched to drain into a full perimeter welded condensate collecting gutter with a 25 mm N.P.T. stainless steel drain fitting at the left rear corner. Drain line shall be extended from the hood to the floor sink below. Welded in the top center of hood shall be an exhaust duct collar sized as shown on the mechanical drawings. Duct collar shall be complete with a balancing damper.

Hood shall be furnished with necessary hanger rods and brackets to secure this condensate hood to the building structure above and the wall behind the hood. Hood shall be supplied with stainless steel closure channels as required to close the gap between the top of the exhaust hood and the finished ceiling. Specifications are based on a Gaylord Model #VH-W wall mount condensate hood.

54 SINK HEATER, BOOSTER:

Contractor Furnished, Contractor Installed.

One only sink heater shall be an electric sink heater measuring 230 mm x 440 mm x 320 mm high. Sink heater shall have a dual reservoir system, one for heating the water and one for trapping and collecting soil from the sink compartment. Sink heater shall have a 50 mm diameter inlet and outlet on the top, a reservoir drain, fiberglass insulation and a stainless steel front panel, body and base. Sink heater shall be mounted

to the underside of the sanitizing sink compartment in accordance with the manufacturer's recommendations. Sink heater shall have a 9.0 K.W. element wired 208-60-3 phase and the load shall be balanced on all three phases. Heating element shall be metal sheathed and controlled by a close tolerance immersion thermostat. The sink heater shall be protected with a high temperature limit switch and low water cut-off. Sink heater shall have an on-off switch, pilot light, low water indicator light and rinse temperature gauge. Sink heater shall be furnished with all standard equipment and shall be in accordance with the manufacturer's standard specifications. Specifications are based on a Hatco Model #3CS-9B.

55 HOOD, EXHAUST:
Contractor Furnished, Contractor Installed.

One only condensate exhaust hood shall measure 1220 mm x 1220 mm x 610 mm high and shall be installed with the bottom edge at 1981 mm above the finished floor. Exhaust hood shall otherwise be identical to the exhaust hood specified under Item #53.

56 CART, STORAGE (POT & PAN):
Government Furnished, Government Installed.

56a RACK, STORAGE FOR MIXER ACCESSORIES:
Government Furnished, Government Installed.

57 CASH REGISTERS:
Government Furnished, Government Installed.

58 OPEN

59 TRAY SLIDE:
Contractor Furnished, Contractor Installed.

Two only tray slide shall be custom fabricated in the size, "U" shape and arrangement as shown on plan and in Schedule of Standard Details at the end of this section. Tray slide shall accommodate 356 mm x 457 mm trays. Each side of the tray slide shall be 900 mm long and the center section shall be 1500 mm long x 355 mm deep. The tray slide shall be constructed of 14 gauge stainless steel and shall be formed in the configuration shown in Schedule of Standard Details at the end of this section. The front vertical edge of the tray slide shall be highlighted to a #7 finish. The rear edge of the tray slide shall be formed up under the turned down edge of the top. The joint between the top and tray slide shall be tight and shall be neatly sealed the full length. The corners and ends of the tray slide shall be mitered as shown on the plan and details. The ends of the tray slide shall be welded closed. The tray slide shall be mounted to the body of the counter (Item #128) with 152 mm high 14 gauge stainless steel brackets spaced 914 mm on center. Brackets shall be secured to the tray slide and counter base. Tray slide shall otherwise be constructed in accordance with Section 2 of the specifications.

60 BREAD DISPENSERS:
Government Furnished, Government Installed.

60a HOT FOOD WELL, 2 PANS:
Contractor Furnished, Contractor Installed.

Two only two section drop-in hot food units shall be by the same manufacturer as the other hot food units and refrigerated pans throughout the project. Hot food units shall measure overall 610 mm wide x 756 mm long x 330 mm deep. Each hot food warmer shall have two individually heated wells, each measuring 305 mm x 508 mm x 152 mm deep. The top flange shall be 18 gauge stainless steel with a raised beaded edge around

the entire perimeter and a solid vinyl gasket to form a tight seal. The wells shall have an inner liner of 18 gauge stainless steel with one piece all welded construction. All corners shall be covered on a minimum of 6 mm radius. Hot food units shall have 25 mm thick high density fiberglass insulation on all sides and 50 mm thick insulation on the bottom. The outer liner shall be constructed of 22 gauge stainless steel.

Each hot food warmer shall be wired 120-60-1 phase and shall have an 1829 mm long cord and NEMA #5-15P plug. Each well shall have an 850 watt heating element and an individual thermostat control. Hot food warmer shall be provided with standard controls mounted below the wells in a stainless steel control panel. Hot food units shall be installed in the Equipment Counters, Item #64 in the locations shown on plan. Hot food warmers shall be mounted into the counter top in accordance with the manufacturer's recommendations and sealed. Specifications are based on Atlas Set-N-Serve Model #WIH-2 hot food warmers.

61 BUTTER DISPENSER:
Government Furnished, Government Installed.

62 DISPENSER, BREAD & BUTTER PLATES:
Government Furnished, Government Installed.

62a DISPENSER, BREAD & BUTTER PLATES AND BOWLS:
Government Furnished, Government Installed.

63 TRAY SLIDE:
Contractor Furnished, Contractor Installed.

Two only tray slides shall be custom fabricated in the size, “L” shape and arrangement as shown on plan and in Schedule of Standard Details at the end of this section. Tray slide shall accommodate 356 mm x 457 mm trays. Each tray slide shall be 1220 mm long on one leg and 2540 mm long on the other leg x 355 mm deep, mounted at 864 mm A.F.F. typical. Remaining same as item #59 except mounted to item 67C.

63a SHELF PROTECTOR (LIGHTED):
Contractor Furnished, Contractor Installed.

Two only lighted shelf protectors shall be mounted to the top of Item #64 as shown on the plan and in Schedule of Standard Details at the end of this section. Each shelf protector shall be a single sided buffet style unit with fluorescent lights. Each protector shelf shall be 820 mm x 457 mm x 457 mm high. Protector shelves shall have a clearance of 305 mm above the counter and shall be mounted on 25 mm square stainless steel posts. Posts shall be secured to the counter top with concealed mounting bolts on the underside. Posts shall be sealed to the top. Each unit shall have 203 mm wide full length stainless steel top shelf with integrally welded end caps. Protector shelves shall have 5 mm thick clear plexiglass sneeze guards with stainless steel channel edging. The underside of the top shelf shall have two rows of fluorescent lights extending the full length. Lights shall be complete with fluorescent tubes with clear plastic safety shields with end caps.

Lights shall be wired 120-60-1 phase and shall have a remote switch mounted in the apron of the counter. Specifications are based on Atlas Set-N-Serve Model #OSC-6 buffet style overshelves.

64 COUNTER, EQUIPMENT:
Contractor Furnished, Contractor Installed.

Two only equipment counters shall be custom fabricated in the size, shape and

arrangement as shown on plan and in Schedule of Standard Details at the end of this section. Each counter shall be 4280 mm long x 762 mm wide x 914 mm high. The top shall be constructed of 14 gauge stainless steel with a 51 mm square turn down edge on all sides. The front edge of counters shall butt tightly against the building wall and the tray slide, Item #67. Joint shall be neatly sealed the full length of the counter. Openings shall be provided in the top for a hot food unit specified under Item #60a. Mounted to the top shall be a sneeze guard specified under Item #63a.

Base of each counter shall be constructed of 18 gauge stainless steel and shall be enclosed on all sides except the working side. The interior of the base shall have a full length 18 gauge stainless steel undershelf measuring 610 mm front to back. Recessed in the undershelf shall be a light switch for the sneeze guard, Item #63a. Sides of undershelf shall be formed up 38 mm square and shall be tack welded and sealed to the body. The rear edge of undershelf shall be formed up 152 mm nigh and tightly hemmed. Counters shall be mounted on 152 mm high, 41 mm diameter stainless steel legs with adjustable stainless steel feet. Equipment counters shall otherwise be constructed in accordance with Section 2 of the specifications.

64a TRAY SLIDE:

Contractor Furnished, Contractor Installed.

Two only tray slide shall be custom fabricated in the size, shape and arrangement as shown on plan. Tray slide shall accommodate 356 mm x 457 mm trays. Tray slide shall be 8100 mm long x 355 mm wide, mounted at 864 mm A.F.F. typical. The tray slide shall be constructed of 14 gauge stainless steel and shall be formed in the configuration shown in Schedule of Standard Details at the end of this section. The front vertical edge of the tray slide shall be highlighted to a #7 finish. The rear edge of the tray slide shall be formed down and anchored to the rear side of the blocking. The rear edge of the tray slide shall fit tight against the front edge of the counters (Items #67 and #75) and shall be neatly sealed the full length. The ends of the tray slide shall fit tight against the building walls and shall be sealed. The tray slide shall be mounted to the partial height wall with 102 mm high 14 gauge stainless steel brackets spaced 914 mm on center. Brackets shall be secured to the tray slide and counter base. Tray slide shall otherwise be constructed in accordance with Section 2 of the specifications.

65 REFRIGERATOR, REACH-IN:

Contractor Furnished, Contractor Installed.

Two only refrigerators, each shall be a two section reach-in unit with a 48.9 cubic feet capacity. Refrigerators shall be fitted with half height doors, hinged as shown on plan. The refrigerators shall have a stainless steel interior and exterior. The front frame shall be extruded thermal plastic providing a thermal break between the interior and exterior of the cabinet eliminating the need for anti-condensate heaters. No heater wires are acceptable. The interior liners shall be crimped construction with 10 mm radius bends for easy cleaning. The refrigerators shall have non CFC polyurethane foam insulation poured, expanded, and bonded in place completely filling all cavities between the inner and outer surfaces of cabinet and doors. The doors shall have heavy duty, cast aluminum, bumper type door handles positioned horizontally with cylinder lock and keys. Chrome plated door hinge mechanisms shall be spring loaded, cam lift design furnished with stops and mounted to reveal full door opening when door is opened past 90 degrees. All doors must be field rehingeable without drilling or defacing the cabinet. Doors shall have single or double padlock posts and plates as required. Doors shall have interior door panels made of one piece ABS thermoplastic. The interior light shall be controlled by a door actuated switch. The vinyl door gaskets shall be easily replaceable without the use of tools. The refrigerators shall have an exterior digital thermometer. The refrigerators shall have 152 mm high stainless steel legs with stainless steel adjustable feet.

Each refrigerator shall be self-contained with a top mounted compressor wired 120-60-1 phase with 3048 mm cord and plug. The refrigeration system shall be complete with condensing fan and fan motor, removable insulated coil housing, and temperature control. Defrosting shall be automatic. The refrigerant shall be metered through a capillary tube. No expansion valves shall be accepted. Each refrigerator shall have a high starting torque 0.25 K.W. compressor rated at 2,600 BTU at 32°C ambient temperature. The refrigeration system shall use R22 refrigerant. The evaporator shall be oversized to operate at -7°C temperature and maintain 80 percent relative humidity. The condenser shall have a heavy duty one piece all aluminum skived fin design to match the motor-compressor rating. No plumbing connections shall be required. The condensate water shall be automatically evaporated from the top of the cabinets. No energy consuming heaters or electrically operated devices are acceptable. The refrigerators shall be furnished with a one year refrigeration service policy on a local level.

Each refrigerator shall be fitted with six only stainless steel wire shelves installed in the lower half. Shelves shall be adjustable on 25 mm centers. The upper half of each refrigerator shall be fitted with 16 pairs of universal pan file slides to hold either one 457 mm x 660 mm pan or two 305 mm x 508 mm pans per slide. Slides shall be stainless steel and shall be adjustable on 25 mm centers. Specifications are based on Hobart Model #QS-2 refrigerators.

66 HOT FOOD WELL (3 PANS):

Contractor Furnished, Contractor Installed.

Four only three section drop-in hot food units shall be by the same manufacturer as the other hot food units and refrigerated pans throughout the project. Hot food units shall measure overall 610 mm wide x 1105 mm long x 330 mm deep. Each hot food warmer shall have three individually heated wells, each measuring 305 mm x 508 mm x 152 mm deep. The top flange shall be 18 gauge stainless steel with a raised beaded edge around the entire perimeter and a solid vinyl gasket to form a tight seal. The wells shall have an inner liner of 18 gauge stainless steel with one piece all welded construction. All corners shall be coved on a minimum of 6 mm radius. Hot food units shall have 25 mm thick high density fiberglass insulation on all sides and 50 mm thick insulation on the bottom. The outer liner shall be constructed of 22 gauge stainless steel. Hot food well should be equipped with drain and manifold.

Each hot food warmer shall be wired 208-60-1 phase and shall have an 1829 mm long cord and NEMA #L6-20P plug. Each well shall have an 850 watt heating element and an individual thermostat control. Hot food warmer shall be provided with standard controls mounted below the wells in a stainless steel control panel. Hot food units shall be installed in the hot/grill counters, Item #67 in the locations shown on plan. Hot food warmers shall be mounted into the counter top in accordance with the manufacturer's recommendations and sealed. Specifications are based on Atlas Set-N-Serve Model #WIH-3 hot food warmers.

66a SHELF PROTECTOR (SNEEZE GUARD):

Contractor Furnished, Contractor Installed.

Four only shelf protectors shall be mounted to the top of the hot/grill counters, Item #67 as shown on the plan in Schedule of Standard Details at the end of this section. Each protector shelf shall be 2161 mm x 318 mm x 356 mm high. Protector shelves shall be mounted on 25 mm square stainless steel posts with the front posts angled back 76 mm at the top. Posts shall be secured to the counter top with concealed mounting bolts on the underside. Posts shall be sealed to the top. Each unit shall have a 241 mm wide full length stainless steel top shelf with all edges formed down square. Front of each

protector shelf shall have a safety glass or 5mm thick clear plexiglass sneeze guard with stainless steel channel edging. The underside of the top shelf shall have a row of fluorescent lights extending the full length. Lights shall be complete with fluorescent tubes with clear plastic safety shields with end caps. Lights shall be wired 120-60-1 phase and shall have a remote switch mounted in the apron of the counter. Specifications are based on Atlas Set-n-Serve Model #PRCL-7 protector case with lights.

66b HOT FOOD WELLS (5 PANS):

Contractor Furnished, Contractor Installed

Two only five section drop in hot food units shall be the same manufacturer as item 66. Hot food units shall measure overall 610 mm wide x 1803 mm long x 330 mm deep. Each hot food warmer shall have three individually heated wells, each measuring 305 mm x 508 mm x 152 mm deep. The top flange shall be 18 gauge stainless steel with a raised beaded edge around the entire perimeter and a solid vinyl gasket to form a tight seal. The wells shall have an inner liner of 18 gauge stainless steel with one piece all welded construction. All corners shall be covered on a minimum of 6 mm radius. Hot food units shall have 25 mm thick high density fiberglass insulation on all sides and 50 mm thick insulation on the bottom. The outer liner shall be constructed of 22 gauge stainless steel. Hot food well should be equipped with drain and manifold.

Each hot food warmer shall be wired 208-60-1 phase and shall have an 1829 mm long cord and NEMA #L6-20P plug. Each well shall have an 850 watt heating element and an individual thermostat control. Hot food warmer shall be provided with standard controls mounted below the wells in a stainless steel control panel. Hot food units shall be installed in the potato/pasta bar hot counter, Item #67c in the locations shown on plan. Specifications are based on Atlas Set-n-Serve Model #WIH-5 Hot Food Warmer.

67 COUNTER, HOT/GRILL:

Contractor Furnished, Contractor Installed.

Two only hot/grill counters shall be custom fabricated in the size, shape and arrangement as shown on plan in Schedule of Standard Details at the end of this section. Each counter shall be 2200 mm long x 850 mm wide x 914 mm high. The top shall be constructed of 14 gauge stainless steel with a 102 mm high x 25 mm wide backsplash against the building wall and a 51 mm square turn down edge on all other sides. The front edge of counters shall butt tightly against the building wall and the tray slides, Items #64a. Joint shall be neatly sealed the full length of the counter. Openings shall be provided in the top for hot food wells specified under Item #66 in the locations shown on plan. Mounted to the top shall be a sneeze guard specified under Item #66a.

Base of each counter shall be constructed of 18 gauge stainless steel and shall be enclosed on all sides except the working side. The working side of the counters shall have a full length 178 mm deep stainless steel apron just below the top. Recessed in the apron shall be a light switch for the sneeze guard, Item #66a. The interior of the base shall have a full length 18 gauge stainless steel undershelf measuring 610 mm front to back. Sides of undershelf shall be formed up 38 mm square and shall be tack welded and sealed to the body. The rear edge of undershelf shall be formed up 152 mm high and tightly hemmed. Counters shall be mounted on 152 mm high, 41 mm diameter stainless steel legs with adjustable stainless steel feet. Hot/grill counters shall otherwise be constructed in accordance with Section 2 of the specifications.

67a TRAY SLIDE:

Contractor Furnished, Contractor Installed.

One only tray slide shall be custom fabricated in the size, shape and arrangement as shown on plan. Tray slide shall accommodate 356 mm x 457 mm trays. Tray slide shall be 6270 mm long x 355 mm wide. The tray slide shall be constructed of 14 gauge stainless steel and shall be formed in the configuration shown in Schedule of Standard Details at the end of this section. The front vertical edge of the tray slide shall be highlighted to a #7 finish. The rear edge of the tray slide shall be formed down and anchored to the rear side of the blocking. The rear edge of the tray slide shall fit tight against the front edge of the counters (Items #64) and shall be neatly sealed the full length. The ends of the tray slide shall fit tight against the building walls and shall be sealed. The tray slide shall be mounted to the partial height wall with 102 mm high 14 gauge stainless steel brackets spaced 914 mm on center. Brackets shall be secured to the tray slide and counter base. Tray slide shall be constructed in accordance with Section 2 of the specifications.

67b TRAY SLIDE:
Contractor Furnished, Contractor Installed.

One only tray slide shall be custom fabricated in the size, shape and arrangement as shown on plan. Tray slide shall accommodate 356 mm x 457 mm trays. Tray slide shall be 6600 mm long x 355 mm wide. The tray slide shall be constructed of 14 gauge stainless steel and shall be formed in the configuration shown in Schedule of Standard Details at the end of this section. The front vertical edge of the tray slide shall be highlighted to a #7 finish. The rear edge of the tray slide shall be formed down and anchored to the rear side of the blocking. The rear edge of the tray slide shall fit tight against the front edge of the counters (Items #64) and shall be neatly sealed the full length. The ends of the tray slide shall fit tight against the building walls and shall be sealed. The tray slide shall be mounted to the partial height wall with 102 mm high 14 gauge stainless steel brackets spaced 914 mm on center. Brackets shall be secured to the tray slide and counter base. Tray slide shall be constructed in accordance with Section 2 of the specifications.

67c COUNTER, HOT (POTATO/PASTA BAR):
Contractor Furnished, Contractor Installed.

Two only hot counters shall be custom-fabricated in an “L” shape to the size and configuration as shown on the plans and in Schedule Of Standard Details at the end of this section. Each counter shall be constructed with one 762 mm wide x 1220 mm long leg and an 800 mm wide x 2540 mm long second leg x 914 mm high. The top shall have a 51 mm square turndown edge on all sides. Recessed in the turndown shall be a light switch for the lighted breath protector, Item 93. The edge of countertop shall butt tightly against the tray slides, Items #63 and #90. Joint shall be neatly sealed the full length of the counter. Openings shall be provided in the top for hot food wells specified under Item #66b in the location shown on the plan. Mounted to top shall be a double sided lighted breath protector, Item #93.

Base of each counter shall be constructed of 18 gauge stainless steel and shall be enclosed on all sides. Hot counter shall otherwise be constructed in accordance with Section 2 of the specifications.

68 DISPENSER, DINNER PLATES:
Government Furnished, Government Installed.

69 GRIDDLE:
Contractor Furnished, Contractor Installed.

Three only griddles, each shall be an electric fired clam shell type griddle measuring

1219 mm x wide 841 mm depth x 679 mm high. Griddles shall have double wall construction with stainless steel finish on front and sides. Each griddle shall have a 25 mm thick smooth polished steel griddle plate slightly pitched to the front for drainage to a full length stainless steel gutter. Griddles shall have an integral one piece stainless steel splash guard welded continuously to griddle plate and grease gutter. Each 305 mm of the griddle surface shall have an electric burner and controlled by a thermostat.

Griddles shall have a 610 mm wide stainless steel hinged broiler that slides horizontally on a rear track. Broiler shall have a single infrared burner rated at 10.3 K.W. (35,000 BTU/hr.). When the broiler is lowered the burner shall be full on with no preheat time. There shall be a 76 mm clearance between the griddle surface and the broiler hood. When the hood is raised, the burner is off.

Griddles shall be wired 120-60-1 phase and shall be furnished with an electrical cord plug. Each clam shell griddle shall be mounted on a portable stand specified under Item #70. Specifications are based on Lang Model #XL-48 griddles.

69a GRIDDLE:

Contractor Furnished, Contractor Installed.

One only griddle shall be an electric fired clam shell type griddle measuring .914 mm wide x 841 mm deep x 679 mm high. . Griddles shall have double wall construction with stainless steel finish on front and sides. Each griddle shall have a 25 mm thick smooth polished steel griddle plate slightly pitched to the front for drainage to a full length stainless steel gutter. Griddles shall have an integral one piece stainless steel splash guard welded continuously to griddle plate and grease gutter. Each 305 mm of the griddle surface shall have an electric burner and controlled by a thermostat.

Griddles shall have a 610 mm wide stainless steel hinged broiler that slides horizontally on a rear track. Broiler shall have a single infrared burner rated at 10.3 K.W. When the broiler is lowered the burner shall be full on with no preheat time. There shall be a 76 mm clearance between the griddle surface and the broiler hood. When the hood is raised, the burner is off. Griddles shall be wired 120-60-1 phase and shall be furnished with an electrical cord plug. Each clam shell griddle shall be mounted on a portable stand specified under Item #70c. Specifications are based on Lang Model #XL-48 griddles.

70 GRIDDLE STAND:

Contractor Furnished, Contractor Installed.

Three only griddle stands shall be by the same manufacturer as the griddles, Item #69. Each stand shall measure 1213 mm x 635 mm x 648 mm high. Stands shall have stainless steel legs, reinforced stainless steel undershelf and casters. Top of each stand shall have stainless steel channels which shall be bolted to the underside of the griddles. Specifications are based on Lang Model #TSC-48 griddle stands.

70a SPLASH GUARD:

Contractor Furnished, Contractor Installed.

Three only splash guards each shall be custom fabricated in the size, shape and arrangement as shown on plan. Splash guards shall be 1524 mm wide x 38 mm thick x 508 mm high. The splash guards shall extend in front of the griddles and stands, Items #69 and 70. Each splash guard shall be supported by six 38 mm square 16 gauge stainless steel posts. The posts shall be welded integrally to the top of the tray slide as shown on detail. The splash guards shall have 6 mm thick tempered glass panels located between the posts and extending from 50 mm above the tray slide to the top of the posts. Each tempered glass panel shall be edged on all sides with stainless steel

channels with corners neatly mitered. The tempered glass panels shall be mounted on channels secured to the inside faces of the posts so the panels can be raised for replacement. Splash guards shall otherwise be constructed in accordance with Section 2 of the specifications.

70b HEAT SHIELD:
Contractor Furnished, Contractor Installed.

Three only heat shields shall each be custom fabricated in the size, shape and arrangement as shown on drawings.

70c GRIDDLE STAND:
Contractor Furnished, Contractor Installed.

One only griddle stand shall be by the same manufacturer as Item 69a. Each stand shall measure 908 mm wide x 635 mm deep x 648 mm high. Each stand shall measure 1213 mm x 635 mm x 648 mm high. Stands shall have stainless steel legs, reinforced stainless steel undershelf and casters. Top of each stand shall have stainless steel channels which shall be bolted to the underside of the griddles. Specifications are based on Lang Model #TSC-36 griddle stands.

70d SPLASH GUARD:
Contractor Furnished, Contractor Installed.

One only splash guard each shall be custom fabricated in size, shape and arrangement as shown on plan. Splash guard shall be 1219 mm wide x 38 mm thick x 508 mm high. Splash guard shall extend in front of the griddle and stand, Item 69a and 70c. Each splash guard shall be supported by six 38 mm square 16 gauge stainless steel posts. The posts shall be welded integrally to the top of the tray slide as shown on detail. The splash guard shall have 6 mm thick tempered glass panels located between the posts and extending from 50 mm above the tray slide to the top of the posts. Each tempered glass panel shall be edged on all sides with stainless steel channels with corners neatly mitered. The tempered glass panels shall be mounted on channels secured to the inside faces of the posts so the panels can be raised for replacement. Splash guard shall otherwise be constructed in accordance with Section 2 of the specifications.

70e HEAT SHIELD:
Contractor Furnished, Contractor Installed.

One only heat shield shall each be custom fabricated in the size, shape and arrangement as shown on drawings.

71 HOOD, EXHAUST:
Contractor Furnished, Contractor Installed.

Three only exhaust hoods shall be constructed by the same manufacturer as Item #39. Each hood shall be a high velocity water wash ventilator constructed in compliance with NFPA #96, BOCA, ICBO (Uniform Mechanical Code), SSBC and ACGHI (American Conference of Governmental Industrial Hygienists). The exhaust hoods shall be U.L. Listed and NSF approved. Exhaust hoods shall be constructed in the size, shape, and arrangement shown on drawing and equipment schedule. The rear side of each hood shall have a one piece 18 gauge stainless steel rear finishing panel. Exhaust hoods shall be complete with high velocity grease extractors, plenum fire dampers, duct collars, make-up air plenums, hanger brackets, auto wash control panels, piping, and nozzles.

Exhaust hoods shall be constructed entirely of 18 gauge type #304 stainless steel with a #4 finish. All external seams and joints shall be welded liquid tight with all exposed welds ground smooth and polished back to original finish. Exhaust hoods shall be furnished with all necessary hanger rods and shall be suspended from building structure above. Hoods shall be supplied with stainless steel closure channels on all sides as required to close the gap between the top of the exhaust hoods and the finished ceiling.

Hoods shall have the same extractor chambers, duct collars, fire dampers, thermostats, and make-up air plenums as specified for Item #39. Hoods shall have fluorescent lights as specified for Item #39, extending the full length of each hood. Each hood shall have a separate wash control panel flush mounted in the wall in the locations shown on plan. These hoods shall otherwise be in accordance with the manufacturer's standard specifications. Specifications are based on Avtec Model #AWWP exhaust hoods.

71a HOOD, EXHAUST:
Contractor Furnished, Contractor Installed.

One only exhaust hood. Each hood shall be a high velocity water was ventilator constructed in compliance with NFPA #96, BOCA, ICBO (Uniform Mechanical Code), SSBC and ACGHI (American Conference of Governmental Industrial Hygienists). The exhaust hood shall be U.L. Listed and NSF approved. Exhaust hood shall be constructed in the size, shape, and arrangement shown on drawing and equipment schedule. The rear side of hood shall have a one piece 18 gauge stainless steel rear finishing panel. Exhaust hood shall be complete with high velocity grease extractors, plenum fire dampers, duct collars, make-up air plenums, hanger brackets, auto wash control panels, piping, and nozzles.

Exhaust hood shall be constructed entirely of 18 gauge type #304 stainless steel with a #4 finish. All external seams and joints shall be welded liquid tight with all exposed welds ground smooth and polished back to original finish. Exhaust hood shall be furnished with all necessary hanger rods and shall be suspended from building structure above. Hood shall be supplied with stainless steel closure channels on all sides as required to close the gap between the top of the exhaust hood and the finished ceiling.

Hood shall have the same extractor chambers, duct collars, fire dampers, thermostats, and make-up air plenums as specified for Item #39. Hood shall have fluorescent lights as specified for Item #39, extending the full length of each hood. Each hood shall have a separate wash control panel flush mounted in the wall in the locations shown on plan. This hood shall otherwise be in accordance with the manufacturer's standard specifications. Specifications are based on Avtec Model #AWWP exhaust hoods.

72 FIRE SUPPRESSION SYSTEM (AUTOMATIC):
Contractor Furnished, Contractor Installed.

Each exhaust hood, Item #71 and 71a shall be furnished with a separate liquid agent fire suppression system which shall be mounted on the wall near the ceiling in the locations shown on plan. No conduit or piping shall be exposed to view. Each fire suppression system shall be a U.L. Listed liquid agent, cartridge operated, regulated pressure system with a fixed nozzle agent distribution network. The systems shall be capable of automatic detection and actuation with local or remote manual actuation. Each fire suppression system shall be provided with a remote manual pull station recessed in the wall in locations shown on plan. The fire suppression systems shall be factory piped and complete with all necessary surface protection nozzles as required by Code. The systems shall be properly sized for the nozzles required. The extinguishing agent shall be a potassium carbonate, potassium acetate-based formulation designed for flame knock down and securement of grease related fires. The regulated release mechanism shall be a spring loaded mechanical/pneumatic type with a nitrogen cartridge for providing the

expellant gas supply to the liquid agent tanks. The regulated release mechanism shall contain a factory installed regulator set at 690 kPa. The mechanism shall have a visual indicator of the cocked or fired position without having to open the enclosure. The fire suppression systems shall have an automatic fusible link detection system. The fire suppression systems shall also have a microswitch to allow the shut-off of all electricity for the items below the exhaust hood. Shut-off devices shall be furnished and installed under other sections of the specifications. All exposed piping for the fire suppression systems shall be chrome plated or chrome sleeved. The fire suppression systems shall be installed in accordance with the Underwriter's Laboratories Listing, NFPA 96 and NFPA 17 and shall conform to all local authorities having jurisdiction over this fire suppression system. Upon completion of the installation of the fire suppression systems, a qualified fire suppression installer shall inspect the system and certify in writing that the systems meet all applicable Codes. Specifications are based on Ansul Model #R-102 systems.

73 CABINET, FOOD WARMING (PASS-THRU):
Contractor Furnished, Contractor Installed.

Two only pass-thru heated cabinets shall each be a two section pass through unit with 1.4 cubic meters capacity constructed by the same manufacturer as Item #29. The heated cabinets shall have stainless steel interior and exterior with a #4 finish and shall be mounted on 150 mm high stainless steel legs with adjustable stainless steel feet. Heated cabinets shall have half height doors on both sides of the cabinet, hinged as shown on the plan. Doors shall have single or double padlock posts and plates as required. The heated cabinets shall be wired 120/208-60-1 phase and shall be installed with the controls on the kitchen side. Interior of heated cabinets shall be fitted with 32 pairs of universal pan file slides to hold either one 460 mm x 660 mm pan or two 305 mm x 510 mm pans per slide. Slides shall be stainless steel and shall be adjustable on 25 mm centers. Specifications are based on Continental Refrigerator Model C-2WDS-2 heated cabinets.

Supplied with each heated cabinet shall be a stainless steel telescope type frame and kick plate to close it into the opening in the building wall. Frame shall be all welded construction of 14 gauge stainless steel and shall extend up the sides of the pass-thru cabinet and across the top on both sides of the wall. Frame shall be of sufficient width at the sides and top to completely cover the opening. All outer edges of the flange shall be terminated in a hug edge tight against the wall and sealed. Frame shall be secured to the wall in a concealed manner. A 14 gauge stainless steel removable kick plate shall be provided on the kitchen side of wall and shall be mounted to the legs of the heated cabinet with spring clips. Framing and kick plate shall be constructed in accordance with Part 2 of these specs.

74 CABINET, PASTRY STORAGE:
Government Furnished, Government Installed.

75 COUNTER, DESSERT:
Contractor Furnished, Contractor Installed.

Two only dessert/condiment counters shall each be custom fabricated in the size, shape and arrangement as shown on plan and in Schedule of Standard Details at the end of this section. The top shall be constructed of 14 gauge stainless steel with a 51 mm square turn down edge on all sides. An opening shall be provided in the top of each counter for a frost pan specified under Item #76. Mounted to the top shall be a sneeze guard specified under Item #77.

Base of each counter shall be constructed of 18 gauge stainless steel and shall be

enclosed on all sides except the working side. Base of these counters shall align with the base of Item #67 and they shall be integrally welded together. The working side of the counters shall have a full length 178 mm deep apron just below the top. Recessed in the apron shall be a light switch for the sneeze guard, Item #77. The interior of the base shall have a full length 18 gauge stainless steel undershelf measuring 610 mm front to back. Sides of undershelf shall be formed up 38 mm square and shall be tack welded and sealed to the body. The rear edge of undershelf shall be formed up 152 mm high and tightly hemmed. Counters shall be mounted on 152 mm high, 41 mm diameter stainless steel legs with adjustable stainless steel feet. Dessert counters shall otherwise be constructed in accordance with Section 2 of the specifications.

76 COLD FOOD FROST TOP:

Contractor Furnished, Contractor Installed.

Two only drop-in refrigerated frost pans shall be constructed by the same manufacturer as all other drop-in hot and cold pans furnished on this project. The frost pans shall measure overall 610 mm wide x 1105 mm long x 457 mm deep with a frost surface of 495 mm wide x 991 mm long. Frost pans shall have a 16 gauge stainless steel frost surface with an 18 gauge stainless steel perimeter flange. The flange shall have a raised beaded edge around the entire perimeter with a solid vinyl gasket under the edge to form a seal. The surface of the frost pans shall be flush with the counter tops. The frost pans shall have a 13 mm drain connection on the left end. Contractor shall extend a 19 mm copper drain line from the frost pans in a concealed manner to the floor drain below. Each frost pan shall be self contained with a 0.19 K.W. compressor mounted in an angle frame on the under side of the pan. Frost pans shall be wired 120-60-1 and shall be complete with 1800 mm cord and plug. The compressor housings shall be painted in a black epoxy enamel. Pans shall be mounted in the counter in accordance with the manufacturer's recommendation and sealed. The frost pans shall be furnished with a one year free refrigeration service policy on a local level. Specifications are based on Atlas Set-N-Serve Model #WF-3 frost pans.

77 BREATH PROTECTOR/DISPLAY SHELVES:

Contractor Furnished, Contractor Installed.

Two only breath protector/display shelves shall be double deck display stands mounted to the top of the dessert/condiment counters, Item #75 as shown on the plan and in Schedule of Standard Details at the end of this section. Each display stand shall be 1210 mm x 508 mm x 584 mm high. Double deck display stands shall be constructed of 25 mm square stainless steel posts secured to the counter top with concealed mounting bolts on the underside. Posts shall be sealed to the top. Each unit shall have a glass shelf at 356 mm and 584 mm above the counter top. Front of each unit, just below each glass shelf, shall have a 152 mm wide safety glass or 5mm thick clear plexiglass sneeze guard mounted on stainless steel pivoting brackets. Glass shelves and sneeze guards shall have stainless steel channel edging. The underside of each shelf shall have a row of fluorescent lights extending the full length. Lights shall be complete with fluorescent tubes with clear plastic safety shields with end caps. Lights shall be wired 120-60-1 phase and shall have a remote switch mounted in the apron of the counter. Specifications are based on Atlas Set-N-Serve Model #DDLC-5 double deck display cases with lights.

78 REFRIGERATOR, ROLL-THRU:

Contractor Furnished, Contractor Installed.

Two only roll-thru refrigerators shall be the same as that specified for Item #29 except without the safety thaw option and furnished with doors on both sides of the cabinets. Roll-thru refrigerators shall be installed in the wall opening as shown on plan with the thermometers located in the kitchen side. Specifications are based on Hobart Model

#QESD-2 refrigerators.

Roll-thru refrigerators shall be furnished with two universal angle racks the same as specified under Item #29. Supplied with each refrigerator shall be a stainless steel telescope type frame and kick plate the same as specified under Item #73.

79 TOASTER:
Government Furnished, Government Installed.

80 DISPENSER, SODA:
Vendor Furnished, Vendor Installed.

81 BEVERAGE COUNTER W/TROUGH:
Contractor Furnished, Contractor Installed.

Two only beverage counters shall be custom fabricated in the size and arrangement as shown on plan and in Schedule of Standard Details at the end of this section. Each counter shall be 4500 mm long x 813 mm wide x 914 mm high. The top shall be constructed of 14 gauge stainless steel with a 102 mm high x 25 mm wide backsplash 25 mm clear of the planter trim and a 51 mm square turn down edge on all other sides. Integrally welded in each top in locations shown on plan shall be one drip troughs measuring 127 mm wide x 25 mm deep. The trough shall be scored and pitched to 38 mm diameter chrome plated brass drain outlet located at the end nearest the floor drain. A 25 mm hard copper drain line shall be extended from the drain to the floor drain below. Top of each counter shall be adequately underbraced to support the weight of the beverage equipment. All openings required in the top for utility lines shall be die formed up and shall be sized to fit each line.

Base of the counter shall be constructed of 18 gauge stainless steel and shall be enclosed on all sides. The front of the counter, below the tray slide mounts, shall have a total of 5 hinged doors. Each door shall be insulated 18 gauge stainless steel double pan construction with full height stainless steel piano hinges and recessed stainless steel pulls. The interior of the base shall have a full length 18 gauge stainless steel undershelf measuring 610 mm front to back with cutouts to accommodate the placement of beverage syrup tanks under the counter, coordinate with tank supplier. Sides of undershelf shall be formed up 38 mm square and shall be tack welded and sealed to the body. The rear edge of undershelf shall be formed up 152 mm high and tightly hemmed. Counters shall be mounted on 152 mm high, 41 mm diameter stainless steel legs with adjustable stainless steel feet. Beverage counters shall otherwise be constructed in accordance with Section 2 of the specifications. Coordinate location of Item # 95A within this counter unit.

81a TRAY SLIDE:
Contractor Furnished, Contractor Installed.

Two only tray slides shall each be custom fabricated in the size and arrangement as shown on plan and in Schedule of Standard Details at the end of this section. Tray slides shall accommodate 356 mm x 457 mm trays. Each tray slide shall be 4500 mm long x 355 mm deep, mounted 864 mm A.F.F. The tray slides shall be constructed of 14 gauge stainless steel and shall be formed in the configuration shown in Schedule of Standard Details at the end of this section. The front vertical edge of the tray slides shall be highlighted to a #7 finish. The rear edge of the tray slides shall be formed up under the turned down edge of the top. The joint between the top and tray slide shall be tight and shall be neatly sealed the full length. The corners and ends of the tray slides shall be mitered as shown on the plan and details. The ends of the tray slides shall be welded closed. The tray slides shall be mounted to the body of the counter (Items #81) with 152 mm high 14 gauge stainless steel brackets spaced 914 mm on center. Brackets

shall be secured to the tray slide and counter base. Tray slides shall otherwise be constructed in accordance with Section 2 of the specifications.

82 HEATER, BOOSTER:

Contractor Furnished, Contractor Installed.

Booster heater shall be an electric heated unit measuring overall 600 mm wide x 580 mm deep x 800 mm high. Booster heater shall be installed with the rear facing the dishwasher, item 104. The booster heater shall have a stainless steel front panel, sides and rear and a stainless steel base mounted on 152mm high legs and adjustable feet. The booster heater shall shall be wired 4800-60-3 phase and shall have the capable of boosting 1477 LPH of 60° C temperature hot water to 82° C. Booster heater shall be equipped with a “Castone” tank, low water cut-off, temperature/pressure relief valve, pressure reducing valve, two temperature/pressure gauges, pilot light and on-off switch. Booster heater shall be equipped with the standard manufacturer's equipment. Specifications are based on Hatco Model No. S-39 booster heater.

83 SANDWICH UNIT:

Government Furnished, Government Installed.

84 ICE DISPENSER:

Contractor Furnished, Contractor Installed.

Two only ice dispensers shall each be a 114 kg manual fill counter top unit. Dispensers shall have a 20 gauge type 304 stainless steel exterior and a plastic bin interior with foamed in place urethane insulation. Ice dispensing shall result from a paddle wheel which lifts and agitates the ice. Ice bins shall have a push button for dispensing the ice and shall also be furnished with a water faucet attachment. Ice dispensers shall have a drain trough with grate. The dispensers shall have a stainless steel front panel in lieu of the standard plastic decor panel. Dispensers shall be mounted and sealed to counter top of beverage counters, Item #81. Ice dispensers shall be wired 120-60-1 phase and complete with 2440 mm cord and plug. Specifications are based on SerVend Model #M-250 dispensers.

85 DISPENSER, JUICE:

Government Furnished, Government Installed.

86 SOUP AND SALAD BAR:

Contractor Furnished, Contractor Installed

Two only soup and salad bars shall be a double sided unit measuring 2960 mm wide x 1200 mm deep x 914 mm high with a refrigerated 6 pan salad bar, 244 mm deep with thermolite template, 120V, 9.6 Amps, 1/3 h.p., #5-15P NEMA Plug and 1 pan hot buffet with sough adaptor plate, 120V, 8.3 Amps, #5-15P NEMA Plug and oak and glass sneezeguard with fluorescent lighting, 120V, .34 Amps, #5-15P NEMA Plug. Bar shall have a solid oak cabinet with laminated panel insets, full undercounter storage with working doors on one side. Top shall be laminated with Biztron tray slides, three per side and concealed castors. Cooling coils shall be in side and bottom. Specifications are based on Yorkcraft Incorporated Unit 3.

87 DISPENSER, MILK:

Government Furnished, Government Installed.

88 DISPENSER, CUP & GLASS:

Government Furnished, Government Installed.

89 HOOD, EXHAUST:

Contractor Furnished, Contractor Installed.

Two only exhaust hoods shall be constructed by the same manufacturer as Item #39. Each hood shall be a high velocity water wash ventilator constructed in compliance with NFPA #96, BOCA, ICBO (Uniform Mechanical Code), SSBC and ACGIH (American Conference of Governmental Industrial Hygienists). The exhaust hoods shall be U.L. Listed and NSF approved. Exhaust hoods shall be constructed in the size, shape, and arrangement shown on drawing and equipment schedule, measuring overall approximately 1680 mm long x 1220 mm wide and 914 mm high. Exhaust hoods shall be complete with high velocity grease extractors, plenum fire dampers, duct collars, make-up air plenums, hanger brackets, auto wash control panels, piping, and nozzles.

Exhaust hoods shall be constructed entirely of 18 gauge type #304 stainless steel with a #4 finish. All external seams and joints shall be welded liquid tight with all exposed welds ground smooth and polished back to original finish. Exhaust hoods shall be furnished with all necessary hanger rods and shall be suspended from building structure above and secured to building wall at rear. Hoods shall be supplied with stainless steel closure channels on front and sides as required to close the gap between the top of the exhaust hoods and the finished ceiling.

Hoods shall have the same extractor chambers, duct collars, fire dampers, thermostats, and make-up air plenums as specified for Item #39. Hoods shall have fluorescent lights as specified for Item #39, extending the full length of each hood. Each hood shall have a separate wash control panel flush mounted in the wall in the locations shown on plan. These hoods shall otherwise be in accordance with the manufacturer's standard specifications. Specifications are based on Avtec Model #AWWP exhaust hoods.

89a FIRE SUPPRESSION SYSTEM (AUTOMATIC):

Contractor Furnished, Contractor Installed.

Each exhaust hood, Item #89, shall be furnished with a separate liquid agent fire suppression system which shall be mounted on the wall near the ceiling in the locations shown on plan. No conduit or piping shall be exposed to view. Each fire suppression system shall be a U.L. Listed liquid agent, cartridge operated, regulated pressure system with a fixed nozzle agent distribution network. The systems shall be capable of automatic detection and actuation with local or remote manual actuation. Each fire suppression system shall be provided with a remote manual pull station recessed in the wall in locations shown on plan. The fire suppression systems shall be factory piped and complete with all necessary surface protection nozzles as required by Code. The systems shall be properly sized for the nozzles required. The extinguishing agent shall be a potassium carbonate, potassium acetate-based formulation designed for flame known down and securement of grease related fires. The regulated release mechanism shall be a spring loaded mechanical/pneumatic type with a nitrogen cartridge for providing the expellant gas supply to the liquid agent tanks. The regulated release mechanism shall contain a factory installed regulator set at 690 kPa. The mechanism shall have a visual indicator of the cocked or fired position without having to open the enclosure. The fire suppression systems shall have an automatic fusible link detection system. The fire suppression systems shall also have a microswitch to allow the shut-off of all gas and electricity for the items below the exhaust hood. Shut-off devices shall be furnished and installed under other sections of the specifications. All exposed piping for the fire suppression systems shall be chrome plated or chrome sleeved. The fire suppression systems shall be installed in accordance with the Underwriter's Laboratories Listing, NFPA 96 and NFPA 17 and shall conform to all local authorities having jurisdiction over this fire suppression system. Upon completion of the installation of the fire suppression systems, a qualified fire suppression installer shall inspect the system and certify in writing that the systems meet all applicable Codes. Specifications are based on Ansul Model #R-102 systems.

90 TRAY SLIDE:

Contractor Furnished, Contractor Installed.

Two only tray slides shall be custom fabricated in the size and arrangement as shown on plans and details and Schedule of Standard Details at the end of this section. Tray slides shall accommodate 356 mm x 457 mm trays. Each tray slide shall be 1775 mm wide x 355 mm deep, mounted 864 mm A.F.F. typical. The tray slides shall be constructed of 14 gauge stainless steel and shall be formed in the configuration shown in Schedule of Standard Details at the end of this section. The front vertical edge of the tray slides shall be highlighted to a #7 finish. The rear edge of the tray slides shall be formed up under the turned down edge of the top. The joint between the top and tray slide shall be tight and shall be neatly sealed the full length. The corners and ends of the tray slides shall be mitered as shown on the plan and details. The ends of the tray slides shall be welded closed. The tray slides shall be mounted to the body of the counters (Items #67c) with 152 mm high 14 gauge stainless steel brackets spaced 914 mm on center. Brackets shall be secured to the tray slide and counter base. Tray slides shall otherwise be constructed in accordance with Section 2 of the specifications.

91 FLOOR TROUGH WITH GRATE:

Contractor Furnished, Contractor Installed.

Two only floor troughs with grates shall be 1219 mm x 304 mm x 102 mm deep and shall be located as shown on plan. Floor troughs and grates shall otherwise be the same as those specified for Item #12.

92 ICE MAKING MACHINE:

Contractor Furnished, Contractor Installed.

Two only ice making machines shall each be a cube type ice maker with an Air Conditioning and Refrigeration Institute certified production capacity of 395 kg of ice per 24 hours at 32°C water temperature in accordance with ARI Standard 810-91. Ice making machines shall have stainless steel exterior panels. Ice making machines shall produce rhomboid shaped cubes measuring 22 mm x 22 mm x 22 mm. Ice making machines shall have an ice thickness control to assure uniform ice thickness without using pressure controls and thermostats or requiring adjustments for fluctuation in air or water temperatures. The evaporator shall be vertical and ice shall be harvested by gravity without mechanical assistance. Each ice making machine shall have an air cooled condenser and shall be wired 208-60-3 phase.

Ice making machines shall be mounted on ARI certified ice bins which shall be rated in accordance with ARI standard 820-88 as having a storage capacity of kg. Ice bins shall be by the same manufacturer as the ice makers. Ice bin liners shall be seamless polyethylene. Overall size of the ice bins shall be 1067 mm wide x 801 mm deep x 1181 mm high including legs. Ice bins shall be furnished with stainless steel exterior finish to match the ice makers and shall be mounted on 165 mm high stainless steel legs with adjustable feet. Ice makers shall be mounted to the top of the ice bins in accordance with the manufacturer's recommendation. The bins shall be equipped with stainless steel adapters to mount 762 mm ice machines. Ice making machines shall be equipped with the manufacturer's standard equipment. Specifications are based on Manitowoc Model #BD-1002A makers and Model #C950S bins.

93 BREATH PROTECTOR (LIGHTED):

Contractor Furnished, Contractor Installed.

Two only lighted breath protector shall be mounted to the top of the salad bar counter,

Item #67c, as shown on the plan and in Schedule of Standard Details at the end of this section. Shelf protector shall be a double sided buffet style unit with fluorescent lights. Protector shelf shall be the size and arrangement as shown on plan and details, measuring 1860 mm wide x 457 mm wide x 457 mm high. Protector shelf shall have a clearance of 305 mm above the counter and shall be mounted on 25 mm square stainless steel posts. Posts shall be secured to the counter top with concealed mounting bolts on the underside. Posts shall be sealed to the top. Unit shall have a 203 mm wide full length stainless steel top shelf with integrally welded end caps. Protector shelf shall have 5 mm thick clear plexiglass sneeze guards with stainless steel channel edging. The underside of the top shelf shall have two rows of fluorescent lights extending the full length. Lights shall be complete with fluorescent tubes with clear plastic safety shields with end caps. Lights shall be wired 120-60-1 phase and shall have a remote switch mounted in the apron of the counter. Specifications are based on Atlas Set-N-Serve Model #OSD5 buffet style overshelves.

94 SYRUP TANK RACK:

Contractor Furnished, Contractor Installed.

One only syrup tank rack shall be an all welded aluminum rack measuring overall 1226 mm long x 610 mm wide x 1778 mm high. Rack shall have a capacity of 25 syrup canisters with a bottom reinforced shelf and three upper shelves. Rack shall be constructed of 25 mm x 50 mm x 3 mm thick extruded aluminum channels with 32 mm x 50 mm x 3 mm channel and 50 mm x 50 mm x 3 mm angle cross bracing. All members shall be fully welded to form a rigid structure. Welded horizontally on the rear and sides between the uprights shall be 25 mm square aluminum tubing to act as retainers for the metal syrup tanks. The uprights shall be fitted with adjustable feet.

The bottom shelf shall be constructed of 2.5 mm aluminum with the rear and ends formed up 25 mm and formed down 50 mm on the front. The bottom shelf shall be reinforced longitudinally with 25 mm x 75 mm x 3 mm tubular members and crosswise with two 50 mm x 100 mm x 3 mm flanged channels. The three upper shelves shall be constructed of 2.5 mm aluminum with formed dividers to hold empty syrup tanks in position. A full length 203 mm x 2.5 mm aluminum panel shall be welded in place on the rear side to provide a mounting surface for the beverage system components supplied by the tank Vendor. The rack shall also be equipped with safety chain to secure the CO_2 cylinders provided by the tank Vendor. The rack shall be furnished in accordance with the manufacturer's standard specifications. Specifications are based on Servolift/Eastern Model #STR3.

95 COFFEE MAKER/DISPENSER:

Contractor Furnished, Contractor Installed.

Two only coffee maker/dispenser shall be a two product liquid concentrate type dispenser measuring overall 432 mm wide x 533 mm deep x 775 mm high. Dispenser shall have a capacity of up to 340 liters of coffee per hour. Dispenser shall have a stainless steel exterior with a hinged door on the front and a drip trough. Dispenser shall hold two 2 liter bag-in-box containers of coffee concentrate. Dispenser shall have two faucets for continuous coffee flow and shall have adjustable coffee strength. Coffee dispenser shall be wired 208-60-1 phase. Specifications are based on a Moccomat (Douwe Egberts) Model Prestige K-72. See Item #95a for preheater water tank for use with this coffee maker .

95a WATER TANK, PREHEATER:

Contractor Furnished, Contractor Installed.

Two only water preheater tanks 400 mm wide x 400 mm deep x 581 mm high shall be a 38 liter water pre-heater, wired 120-60-1 phase. Furnished as an auxillary unit with the

coffee dispenser and mounted in the base of the beverage counter, Item #81. Water heater shall have a temperature range of 43° to 77°C and shall be preset at 49°C. Specifications are based on a Vanguard Model #6E730.

96 DISPENSER, FLATWARE WITH 6 CYLINDERS:
Contractor Furnished, Contractor Installed.

Four only counter top flatware dispensers measuring 375 mm wide x 292 mm deep x 219 mm high. Each unit shall be constructed of stainless steel with a sloped top with 6 flatware cylinder holes. Unit shall be furnished with 6 plastic flatware cylinders, 102mm in diameter x 137mm deep. Specifications are based on Steril-Sil Model TC-65.

97 STAND, CONDIMENT:
Contractor Furnished, Contractor Installed.

One only condiment stands shall be custom fabricated in the size and arrangement as shown on plan and in Schedule of Standard Details at the end of this section. Stand shall be 3000 mm wide x 650 mm deep x 914 mm high. The tops shall be constructed of 14 gauge stainless steel with a 51 mm square turn down edge on all sides.

Base of the counter shall be constructed of 18 gauge stainless steel and shall be enclosed on all sides. The front of the counter, below the tray slide mounts, shall have a total of 5 hinged doors. Each door shall be insulated 18 gauge stainless steel double pan construction with full height stainless steel piano hinges and recessed stainless steel pulls. The interior of the base shall have a full length 18 gauge stainless steel undershelf measuring 610 mm front to back. Sides of undershelf shall be formed up 38 mm square and shall be tack welded and sealed to the body. The rear edge of undershelf shall be formed up 152 mm high and tightly hemmed. Counters shall be mounted on 152 mm high, 41 mm diameter stainless steel legs with adjustable stainless steel feet. Beverage counters shall otherwise be constructed in accordance with Section 2 of the specifications.

97a TRAY SLIDE:
Contractor Furnished, Contractor Installed.

Two only tray slides shall be custom fabricated in the size and arrangement as shown on plan. Tray slides shall accommodate 356 mm x 457 mm trays. Each tray slide shall be 3000 mm long x 355 mm wide. The tray slides shall be constructed of 14 gauge stainless steel and shall be formed in the configuration shown in Schedule of Standard Details at the end of this section. the front vertical edge of the tray slides shall be highlighted to a #7 finish. The rear edge of the tray slides shall be formed up under the turned down edge of the top. The joint between the tops and tray slides shall be tight and shall be neatly sealed the full length. The ends of the tray slides shall be mitered as shown on the plan and details. The ends of the tray slides shall be welded closed. The tray slides shall be mounted to the body of the counters (Items #97) with 152 mm high 14 gauge stainless steel brackets spaced 914 mm on center. Brackets shall be secured to the tray slide and counter base. Tray slides shall otherwise be constructed in accordance with Section 2 of the specifications.

98 RACK, CONDIMENT PACKS (9 BINS):
Contractor Furnished, Contractor Installed.

Two only condiment pack racks shall each include the rack and containers. Each three tiered rack shall be constructed of polyethylene and shall accommodate and be furnished with three rows of three condiment bins, total of nine. Each condiment bin shall be

constructed of polyethylene and shall measure 125 mm wide x 305 mm deep x 110 mm high. Each bin shall be mounted to the rack with a grooved ledge molded into the rear of each bin. The bins and racks shall be in black color. Specifications are based on Cambro Model #9R9.

99 MICROWAVE OVEN:

Contractor Furnished, Contractor Installed.

Two only microwave ovens measuring 586 mm wide x 600 mm deep x 392 mm high. Each unit shall have 1400 watts of cooking power with a digital display timer and touch button stying. Oven shall have a see through door with a lighted cavity. Microwave should be wired 208V, single phase, 3.3 k.w. with a 1524 mm, #6-30P power cord. Specifications are based on Litton Model LC-14EVP.

100 DISPENSER, NAPKIN:

Government Furnished, Government Installed.

101 SOFT SERVE MACHINE:

Contractor Furnished, Contractor Installed.

Two only soft serve machines shall each be an air cooled, self-contained, floor model with heat treatment system. Each machine shall measure overall approximately 672 mm wide x 838 mm deep x 1521 mm high. Each machine shall have the capacity to have two flavors and a combination of both flavors in a twist shape. Each machine shall be constructed of stainless steel and mounted on 191 mm legs with casters. Each machine shall have two 3.2 liter freezing cylinders, two 18.9 liter insulated mix hoppers, indicator lights for insufficient mix level, electronic controls for product consistency and power interrupt and lock-out if product reaches unsafe temperatures. Each machine shall have two 1.1 k.w. beater motors and two approximately 9,500 BTU/HR compressors utilizing R404A refrigerant. Each machine shall be wired 208-60-3 phase for two hard wired connections. Each machine shall be self service and equipped with draw valve lock kit. Specifications are based on Taylor Model #H84.

102 CONVEYOR:

Contractor Furnished, Contractor Installed.

Two only conveyors shall each be custom fabricated in the size, shape and arrangement as shown on the drawings, measuring overall approximately 5105 mm long (verify in field) x 600 mm wide as indicated on the plan x 864 mm high. Each top shall be constructed of one piece 14 gauge, type 304, 18-8 stainless steel with a #4 finish. Each top shall be formed up against the walls, as indicated on the plan, 254 mm in the configuration as indicated in Schedule of Standard Details at the end of this section. The backsplash shall be attached to the wall with "Z" clips. Each top, in the dish room, shall be formed up into a 76 mm high x 38 mm diameter rolled rim. Each top in the tray return area shall be mitered up 64 mm and then formed out over the short wall as indicated on the above referenced Detail and down 51 mm, or to cover the sill plate. The center of each top shall have a full length coved corner recessed area sized for the roller conveyor. Each conveyer shall be a 14 gauge stainless steel angle frame for raised rollers in four equal sections. The angle frames shall be equipped with 376 mm long x 48 mm diameter plastic rollers on 102 mm centers. Each roller shall be equipped with noncorrosive ball bearings with stainless steel hexagonal shaft. The shaft shall be provided with self-locking snap-in mechanism without cotter pins or locking rings. Each roller conveyor shall be gravity operated with the pitch not to exceed 7 degrees. Specifications are based on Caddy Model #RCF Roller-veyor. The roller conveyor shall transport 356 mm x 452 mm trays.

Each top shall be mounted on an open tube stainless steel base with cross and

longitudinal rails as indicated in Schedule of Standard Details at the end of this section. The legs shall be fitted with stainless steel 50 mm adjustable feet. The bases shall be stabilized to the wall with brackets as indicated on the Detail. The low end of each recess for the roller conveyor is to be fitted with a 50 mm diameter drain. Provide plastic strip curtains at the openings into the dishwashing room over each conveyor. The bottom of the strip curtains shall provide a 305 mm clearance above the roller conveyor. Each backsplash and rolled rim, on the dish room side of the opening from the tray return areas, shall have a water-tight notch to accommodate the metal coiling counter door.

Each conveyor and table shall be integral with Item #103 and shall be coordinated with Items #15 and #115. Each conveyor shall otherwise be constructed in accordance with Section 2 of these specifications.

103 DISHTABLE, SOILED (WITH TROUGH):

Contractor Furnished, Contractor Installed.

Two only soiled dish tables shall each be custom fabricated in the size, shape and arrangement as shown on the drawings, measuring overall approximately 3500 mm long x 800 mm wide x 864 mm high . Each top shall be constructed of one piece 14 gauge, type 304, 18-8 stainless steel with a #4 finish. Each top shall be formed up against the rear wall, as indicated on the plan, 305 mm in the configuration as indicated in Schedule of Standard Details at the end of this section. The backsplash shall be attached to the wall with "Z" clips. The front edge of each top in the dish room shall be formed up into a 76 mm high x 38 mm diameter rolled rim. Formed integrally into the front side of each dishtable shall be trough sized as indicated on the drawings and to the waste pulper system, Item #15. Each trough shall have coved corners and sloped to the disposer/grinder of the pulper system as required. The shallow end of each trough shall be fitted with the return water inlet and diffuser as required by the pulping system. The return piping of the pulper system shall be strapped to the underside of each table top behind the trough in an approved manner. The opposite end of each trough shall be angled to the trough connection on the pulper/grinder and mated to the trough connection as required by the pulping system. A full width portion of each waste trough, adjacent to the pulper/grinder location, shall be recessed 102 mm deep and shall measure 609 mm long. Each recessed area shall be provided as a silver saver. Half of the recessed area shall be sloped back up to the pulper/grinder flange trough connection. The bottom of each recess shall be fitted with a 50 mm drain. The table tops shall pitch to the troughs.

Each top shall be mounted on an open tube stainless steel base as indicated in Schedule of Standard Details at the end of this section with cross and longitudinal rail bracing and intermediate vertical supports. The rear of the open tube bases shall be stabilized to the wall with brackets as indicated on the Detail. The legs shall be fitted with stainless steel 50mm adjustable feet.

Each soiled dishtable shall be integral with Items #102 and #111 and shall be coordinated with Items #15, #108, #112 and #115. Each dishtable shall otherwise be constructed in accordance with Section 2 of these specifications.

104 DISHWASHING MACHINE:

Contractor Furnished, Contractor Installed.

One only dishwashing machine shall be a fully automatic rack type machine for left to right operation. The dishwashing maching shall measure overall 2788mm long x 770mm wide x 1768mm high. The dishwashing machine shall have a 558 mm pre-wash section, a 1117 mm power wash section and a 1117 mm power rinse and final rinse section. The dishwashing machine shall have a capacity of (367) 508 mm x 508 mm

racks per hour. The dishwashing machine shall have stainless steel pump and impeller, easily removable stainless steel wash and power rinse arms and stainless steel frame, legs and 50mm adjustable feet. The dishwashing machine shall have stainless steel front panel and a full size removable stainless steel rear finished panel constructed in sections to match the sections of the dishwasher. The dishwashing machine shall have automatic fill, auto timer, table limit switch, built-in integral wiring channel, removable self-flushing stainless steel strainer pans and baskets. The dishwashing machine shall have door interlocks, door actuated drain closer, common drain at the soiled end, solid state automatic thermistor temperature control and positive low water heater and pump seal protection. The dishwashing machine shall have electric tank heat with the motors and heat wired 208-60-3 phase with single point electrical connection. The dishwashing machine shall have a 120 volt pilot circuit. Dishwashing machine shall also be equipped with vent fan control feature.

Each end of the dishwashing machine shall be equipped with an extended vent hood with locking damper. The bottom front and rear of each extended vent hood shall be equipped with 14 gauge stainless steel extensions to close the gap between the bottom of the extended vent hood and the rolled rim of the dishtable. The dishwashing machine shall be equipped with a total of six only heavy duty plastic peg type racks and four only combination type racks. Dishwashing machine shall be equipped with the manufacturer's standard equipment. Coordinate with Item #82 (Booster heater) installation. Specifications are based on a Hobart Model #CRS-110A dishwasher.

105 WATER PULPING EXTRACTOR:

Contractor Furnished, Contractor Installed.

One only waste pulping extractor shall be by the same manufacturer as the other components of the waste system - the waste pulpers, Item #15 and the disposers, Item #24. The extractor shall have a capacity of 1818 kg per hour of foodservice waste mix, consisting of food scraps, plastics, milk cartons, paper, aluminum foil and cardboard. The extractor shall consist of a rigid stainless steel weldment with stainless steel legs, head assembly with two 3.7 k.w. totally enclosed, fan cooled, belt driven motors each matched to a 25:1 gear reducer, 711 mm long stainless steel discharge chute with limit switch, chemical additive pump and automatic rinse system. The water extractor mechanism shall consist of two 229 mm diameter stainless steel screws each with a nylon brush edge, stainless steel adjustable gate and matching 229 mm diameter reinforced stainless steel screen. The extractor shall be equipped a pulp level detector. The extractor shall be equipped with a 5.6 k.w. return pump. The extractor shall be wired 208-60-3 phase and shall have a total load of 40.0 amps.

All exterior surfaces, except where polished stainless steel shall be prime coated and finished with two coats of enamel paint. The extractor installation shall be coordinated with Items #15 and #24 to function as a complete system. The specifications are based on a Somat Model #HE-9S extractor.

106 DOLLY:

Government Furnished, Government Installed.

107 DUCT SET:

Contractor Furnished, Contractor Installed.

Two only ducts shall be custom fabricated in the size, shape and arrangement as shown on the plan, measuring overall approximately 102 mm x 406 mm . Each duct shall be constructed of all welded 18 gauge type 304, 18-8 stainless steel. Each duct shall extend straight up from the locking damper assembly on the dishwashing machine extended vent hoods, through the finished ceiling and then tied to the building exhaust system. Each duct shall fit inside the locking damper assembly (Item #104) and shall be water-

tight. Each vent duct at the ceiling shall be fitted with an 18 gauge stainless steel flange measuring overall approximately 38 mm x 38 mm which shall be tack welded to the duct to keep the vent duct rigid. The vent ducts shall otherwise be constructed in accordance with Section 2 of these specifications.

108 SILVER, SOAK SINK:
Government Furnished, Government Installed.

109 SERVICE SINKS (FLOOR MOUNTED):
Contractor Furnished, Contractor Installed.

Two only service sinks shall each be constructed of 16 gauge, type 304 stainless steel with a deep drawn seamless sink bowl with a "V" edge on three sides. The rear edge shall be formed up into a tile edge. Each sink shall measure overall 838 mm wide x 635 mm front to back x 406 mm high. Each service sink shall be equipped with a 50 mm drain, service faucet, mop hanger, hose and bracket. Each service sink shall be in accordance with the manufacturer's standard specifications. Specifications are based on Advance Model #9-OP-48 service sink and accessories.

110 DISHTABLE, CLEAN:
Contractor Furnished, Contractor Installed.

One only clean dishtable shall be custom fabricated in the size, shape and arrangement as shown on the plan, measuring overall approximately 3658 mm long x 762 mm wide x 864 mm high (Field verify all dimensions). Top shall be constructed of 14 gauge, type 304, 18-8 stainless steel with the free edges formed up into a 76 mm high x 38 mm diameter rolled rim. The remaining edge shall be formed down into the dishwashing machine, Item #104, and shall be secured and sealed in place. The top shall be mounted on an open tube stainless steel base with stainless steel 50mmadjustable flanged feet. The base of the table shall be equipped with a stainless steel undershelf from the free end to the booster heater. The clean dishtable shall otherwise be constructed in accordance with Section 2 of these specifications.

111 CONVEYOR SYSTEM:
Contractor Furnished, Contractor Installed.

One only conveyor system shall be custom fabricated in the size, shape and arrangement as shown on the drawing, measuring overall approximately 7699 mm long x 635 mm wide x 864 mm high . Top shall be constructed of one piece 14 gauge, type 304, 18-8 stainless steel with a #4 finish. The entire top shall be recessed to accommodate the roller conveyor sections with the top of the rollers at the same height as the top of Item #103. Top shall be formed up against the walls, as indicated on the plan the height to match the backsplash of Item #103. The backsplash shall be in the configuration as indicated in Schedule of Standard Details at the end of this section. The backsplash shall be attached to the wall with "Z" clips. The front edges of the top shall be formed up into a 38 mm diameter rolled rim with the height of the rim to match the rim on Item #103. The ends of the top adjacent to Items #103 shall be formed up and welded integrally to Items #103. The end of the table adjacent to Item #104, Dishwashing Machine, shall be formed up, over and down into Item #104, secured and sealed in place. The recessed area of the table shall not interfere with the soiled end of the dishwashing machine below the table top. The top shall have three 50 mm drains.

Mounted into the recessed top shall be roller conveyor sections. The roller conveyor sections shall transport 508 mm x 508 mm dish racks and shall have 559 mm long stainless steel rollers on 102 mm centers. The roller conveyor sections shall have stainless steel angle frame for raised rollers, similar to that specified under Item #102. The frame for the two curved sections shall be constructed of 12 gauge stainless steel flat

bar with 14 gauge stainless steel angle crossbars at both ends and intermediate locations. The roller conveyor shall be gravity operated with the pitch not to exceed 7 degrees. The straight sections of the roller conveyor shall be in equal lengths, not to exceed 1067 mm. The sections of the roller conveyor shall be connected in a removable manner. Specifications are based on Caddy Model #RA-28-S frame with Model #R-30-S rollers. The curved sections are based on Caddy Model #RA-36-S with stainless steel rollers.

Top shall be mounted on an open tube stainless steel base with cross and longitudinal rails as indicated in Schedule of Standard Details at the end of this section. The legs shall be fitted with stainless steel 50mm adjustable feet. The bases shall be stabilized to the wall with brackets as indicated on the Detail. The conveyor shall be coordinated with Items #103 and #104. Each conveyor shall otherwise be constructed in accordance with Section 2 of these specifications.

112 SPRAY ASSEMBLY:
Contractor Furnished, Contractor Installed.

Two only spray assemblies shall each be a backsplash mounted spring action unit with water inlets on 203 mm centers. Each assembly shall be equipped with a faucet, riser pipe, wall bracket, stainless steel flexible hose, spring coil, squeeze valve and low flow spray valve. Faucet shall be equipped with lever handles. Each unit shall be chrome plated, except for the stainless steel parts and the nonmetal parts of the nozzle. Each spray assembly shall be mounted to Item #103 as indicated on the plan. Specifications are based on T & S Model #B-0133C assembly.

113 CLEAN/SANITIZING MACHINE:
Government Furnished, Government Installed.

114 BOWL, DISPENSER WITH COVER:
Government Furnished, Government Installed.

115 WALL SHELF:
Contractor Furnished, Contractor Installed.

Six only open tubular wall shelves shall each be in the size, shape and arrangement as shown on the drawing. The solid ends shall be constructed of 14 gauge type 304 stainless steel. The four tubes shall be 41 mm 18 gauge stainless steel tubing and shall be TIG welded to the solid ends. Each shelf shall be mounted to the wall with the bottom of the shelf mounted 508 mm above the top of Items #103 and #111. Shelves to be used for the slanted storage of dishwasher racks. Specifications are based on Advance Model #DT-6R-03 shelves.

116 SHELF, STAINLESS STEEL FLAT:
Contractor Furnished, Contractor Installed.

Two only wall shelves shall each be in the size, shape and arrangement as shown on the drawing. Each shelf shall be constructed of 18 gauge stainless steel with the front rolled down 38 mm and the rear and ends formed up 25 mm. Each shelf shall be mounted to the wall 1829 mm above the finished floor. Specifications are based on Advance Model #WS-10-72 shelves.

117 TRAY DISPENSER:
Government Furnished, Government Installed.

118 BREAD RACK:
Furnished by Vendor.

119 PROOFING CABINET:

Government Furnished, Government Installed.

One only proofing cabinet shall be formed and welded 10 gauge aluminum top, 12 guage aluminum base. Extruded aluminum angles for (17) 457 x 660 mm pans, riveted on 76 mm centers. Field reversible brushes 14 gauge aluminum door. removable 1000 Watt, 120 Volt power unit. Controls accessible without opening door. front drip trough. 127 mm swivel neoprene casters, permanently lubricated, sealed ball bearing. Load capacity 91 kg each. Two year parts warranty. Specifications are based on Cres Cor Model #121-1816B.

120 DISPLAY REFRIGERATOR:

Contractor Furnished, Contractor Installed.

Two only display refrigerators shall each be a self contained air cooled unit wired 120-60-1 phase with a .5 k.w. compressor complete with 1800 mm cord and NEMA #5-20P plug. Each refrigerator shall have a refrigerated base and a refrigerated upper display structure. The top of each refrigerator shall be constructed of 16 gauge stainless steel with a 76 mm deep sloped nosing on front. The exterior sides of each base shall be equipped with finished 18 gauge stainless steel panels. Each base shall have 50 mm foamed-in-place polyurethane. The interior of each base shall have 22 gauge stainless steel back and bottom with the ends constructed of ABS material. Each base shall have two stainless steel doors with ABS material interior liners. Each base shall be equipped with a shelf behind each door. Each base shall be complete with a blower coil to fit behind the door mullion and a compressor housing with louvered stainless steel front panel.

The upper refrigerated structure shall be 762 mm deep and shall be insulated with foamed-in-place polyurethane. Each upper display structure shall be supplied with 18 gauge stainless steel exterior sides. The front of each upper display structure shall be equipped with two tempered thermopane, self-closing, glass doors. Each upper display shall have stainless steel back with ABS material ends. Each upper refrigerated structure shall be equipped with four epoxy coated wire shelves. Each upper refrigerated structure shall be equipped with a blower coil mounted in the top of the unit with two coils and one low velocity fan. Each coil shall be equipped with a 20 gauge stainless steel cover.

Each display refrigerator shall be mounted on 254 mm high stainless steel legs with 50mm adjustable feet. Each display refrigerator shall be equipped with the manufacturer's standard equipment. Specifications are based on Delfield Model #V-15048-M-32 refrigerators.

121 ELECTRONIC MENU BOARD:

Contractor Furnished, Contractor Installed.

Two only electronic menu boards shall be wall mounted, stand-alone versions with 16 line directory display, wooden frame, non-glare glazing and keyboard. Unit shall measure 622mm wide x 152mm deep x 1219mm high and shall be provided with associated system componets for a complete and usable system. Specifications are based on Morrow Technologies, Janus Computerized Events Display, Standard Model.

122 SERVICE SINK:

Contractor Furnished, Contractor Installed.

Two only service sinks in the dishwashing room (room 140) and can wash (room 105) shall be a stainless steel sink mounted on legs and shall measure overall 991mm x 622mm x 838mm high to the front rim. Service sink shall be constructed of 16 gauge

type 304 stainless steel with a 75mm high x 38mm diameter rolled rim on the front and right end. The left end and rear in room 105 and rear in room 140 shall be formed into a 254mm high x 50mm thick backsplash against the building wall. The sink compartment shall be deep drawn and shall measure 914mm x 533mm x 356mm deep. Sink shall be mounted on 41mm diameter stainless steel legs with stainless steel gussets, cross rails, and 25mm adjustable stainless steel bullet feet. Sink shall have a twist handle drain with overflow and a backsplash mounted faucet with goose neck spout as specified in Section 2.7.1.2. Specifications are based on an Advance Model No. 4-41-24 sink.

123 COFFEE URN:

Contractor Furnished, Contractor Installed.

One only coffee urn shall be a fully automatic electric heated dual wall insulated single tank coffee brewer and dispenser. Coffee urn shall measure overall 559mm wide x 451mm deep x 889mm high. Coffee urn shall be costructed of 304, 18-8 stainless steel. Coffee urn shall have fresh water brewing in a closed chamber and brew up to 68 LPH. Coffee urn shall have automatic refill of water jacket, automatic coffee agitation and adjustable by-pass on spray arm and Teflon coating on spray armpiston. Coffee urn shall have dial thermometer with marked brew zone and low water cut-off. Coffee urn shall be equipped with NSF covers and stainless steel brew basket with 25 filter papers. Coffee urn shall have a bottom drain valve with hose connection. Coffee urn shall be equipped with coffee, water faucets with glass gauges and 1800 mm cord. Coffee urn shall otherwise be equipped with the manufacturer's standard equipment. Specifications are based on American Brewing System Model No. 8116 space saver urn.

124 DRINK REFILL COUNTER WITH TROUGH:

Contractor Furnished, Contractor Installed

Two only drink refill counters shall be custom fabricated in the size and arrangement as shown on plan and in Schedule of Standard Details at the end of this section. Each counter shall measure 2800 mm wide x 750 mm deep x 914 mm high. The top shall be constructed of 14 gauge stainless steel with a 102 mm high x 25 mm wide backsplash against the building walls and a 51 mm square turn down edge on all other sides. Integrally welded in each top in locations shown on plan shall be two drip troughs measuring 127 mm wide x 25 mm deep. Each trough shall be scored and pitched to 38 mm diameter chrome plated brass drain outlet located at the end nearest the floor drain. A 25 mm hard copper drain line shall be extended from each drain to the floor drain below. Top of each counter shall be adequately underbraced to support the weight of the beverage equipment. All openings required in the top for utility lines shall be die formed up and shall be sized to fit each line.

Base of each counter shall be constructed of 18 gauge stainless steel and shall be enclosed on all sides. The front of each stand, below the tray slide mounts, shall have a total of 5 hinged doors. Each door shall be insulated 18 gauge stainless steel double pan construction with full height stainless steel piano hinges and recessed stainless steel pulls. The interior of the base shall have a full length 18 gauge stainless steel undershelf measuring 610 mm front to back. Sides of undershelf shall be formed up 38 mm square and shall be tack welded and sealed to the body. The rear edge of undershelf shall be formed up 152 mm high and tightly hemmed. Counters shall be mounted on 152 mm high, 41 mm diameter stainless steel legs with 50 mm adjustable stainless steel feet. Beverage counters shall otherwise be constructed in accordance with Section 2 of the specifications.

125 TRAY SLIDE:

Contractor Furnished, Contractor Installed

Two only tray slides shall be custom fabricated in the size and arrangement as shown on plan and in Schedule of Standard Details at the end of this section. Each tray slide shall be 2800 mm wide x 355 mm deep, mounted 864 mm A.F.F. typical. The tray slides shall be constructed of 14 gauge stainless steel and shall be formed in the configuration shown in Schedule of Standard Details at the end of this section. The front vertical edge of the tray slides shall be highlighted to a #7 finish. The rear edge of the tray slides shall be formed up under the turned down edge of the top. The joint between the top and tray slide shall be tight and shall be neatly sealed the full length. The corners and ends of the tray slides shall be mitered as shown on the plan and details. The ends of the tray slides shall be welded closed. The tray slides shall be mounted to the body of the counters (Item #124) with 152 mm high 14 gauge stainless steel brackets spaced 914 mm on center. Brackets shall be secured to the tray slide and counter base. Tray slides shall otherwise be constructed in accordance with Section 2 of the specifications.

126 CAPPUCCINO MACHINES:
Contractor Furnished, Contractor Installed

Two only cappuccino maker/dispenser shall be a four flavor model measuring 425 mm wide x 550 mm deep x 850 mm high with a 22 liter water tank. Unit should be of manual dispensing type with a 36.8 g per second rate & equipped with Vacuum Steam Removal System (VSRS) to insure the cappuccino product will remain dry to eliminate clogging, caking and bridging. Cup clearance should be 177 mm high minimum with a 76 mm high x 381 mm deep stainless steel drip tray. Unit should have “power whip” function and self cleaning feature. Maker/dispenser shall be wired 120 VAC, 1.8kw, 1800 mm cord with NEMA 5-15R plug and have a 6 mm water line hook-up. Specifications are based on a Cecilware Model GB4-LD.

127 JUICE DISPENSER:
Government Furnished, Government Installed

128 CASHIER STAND:
Contractor Furnished, Contractor Installed

Two only cashier stands shall be custom fabricated in the size and arrangement as shown on plan, details and Schedule of Standard Details at the end of this section. Each stand shall be 1500 mm wide x 900 mm deep x 914 mm high. The tops shall be constructed of 14 gauge stainless steel with a 51 mm square turndown edge on all sides. Base of cashier stand shall be constructed of 18 gauge stainless steel and shall be enclosed on all sides except the working side. Interior of stand front shall have frame work to support the tray slide specified under Item #59. The interior of the base shall have a full length 18 gauge stainless steel undershelf measuring 610 mm front to back. Sides of undershelf shall be formed up 38 mm square and shall be tack weld and sealed to the body. The rear edge of undershelf shall be formed up 152 mm high and tightly hemmed. Stands shall be mounted on 152 mm high, and 41 mm diameter stainless steel legs with 50 mm adjustable stainless steel feet. Cashier stands shall otherwise be constructed in accordance with Section 2 of the specifications.

C1 HAND SINKS (S/S):
Contractor Furnished, Contractor Installed.

One only hand sinks shall each have one piece deep drawn heavy gauge stainless steel construction with all vertical and horizontal corners coved. Hand sinks shall measure overall 438 mm long x 387 mm wide with a bowl size of 356 mm x 254 mm x 127 mm deep. Hand sinks shall have an integral 197 mm high backsplash with a 50 mm 2" turn

back on a 45° angle. The hand sinks shall be furnished with a stainless steel skirt on the front and both sides. Hand sinks shall be installed with the front rim at 863 mm above the finished floor.

Each hand sink shall be furnished with a stainless steel paper towel dispenser designed to dispense "C" fold paper towels. Paper towel dispenser shall be mounted to the sink backsplash and shall measure 438 mm long x 102 mm wide x 498 mm high. Mounted to the front of the towel dispenser at the left end shall be a soap dispenser.

Hand sinks shall have two openings in the backsplash at 100 mm on center. Mounted to the backsplash shall be a standard faucet with wrist action handles and a swivel goose neck spout with aerator. Each sink shall be equipped with a 38 mm stainless steel basket drain, a lever operated drain with built-in overflow with plastic overflow tube and spring clips. Specifications are based on Advance Tabco Model #75-PS-85 sinks.

C2 DUNNAGE SHELVING, MOBILE:
Government Furnished, Government Installed.

C3 CASH REGISTER:
Government Furnished, Government Installed.

C4 REFRIGERATOR/WARMER, REACH-IN:
Contractor Furnished, Contractor Installed.

One only 2-section, self contained reach-in refrigerator-heated cabinet with a net capacity of 1.46 cubic meters. Exterior cabinet shall be constructed of heavy gauge stainless steel with a # 4 finish and exterior flush mounted dial thermometer. Interior panels and door liners shall be stainless steel. Unit shall be furnished with four half length doors, six stainless steel shelves and 152 mm high stainless steel legs with 50 mm adjustable feet. Overall dimensions: 1473 mm wide x 887 mm deep x 2115 mm high. Specifications are based on Traulsen & Company Model No. RHD 2-32W UT.

C5 OPEN NUMBER

C6 CONVEYOR TOASTER:
Contractor Furnished, Contractor Installed.

One only conveyor toaster shall run 900 Half Slices of Buns Per Hour, Conveyorized Toaster, w/Speed Control, w/Manual Advance, 1800 mm cord with NEMA 6-30 P plug, HATCO Model TK-100.

C7 TABLE/EQUIPMENT STAND:
Contractor Furnished, Contractor Installed.

Stand shall be stainless steel portable wing table for use with item #C6. Specifications are based on Lakeside Mfr., Inc. Model No. 110.

C8 EQUIPMENT STAND:
Contractor Furnished, Contractor Installed.

One only custom built per plans and standard details 1.06, 1.06.1, 1.08, and 4.03.

C9 FOOD WARMER:
Contractor Furnished, Contractor Installed.

One only food warmer measuring 310 mm wide x 610 mm deep x 510 mm high with an optional food holding pan. Warmer shall have a thermo-controlled base that

conducts heat from the bottom while an infrared element heats from above. A swing away top allows fast and easy access to food pans. Unit shall have a clearance of 410 mm between heated base and upper housing. Warmer to be wired 120V, single phase, 7.7 Amps and be equipped with 1800 mm cord with a NEMA #5-15P electrical plug. Specification is based on Hatco Model GR-FFBL*.

C10 HOOD, EXHAUST:

Contractor Furnished, Contractor Installed.

One only exhaust hood shall be constructed by the same manufacturer as Item #39. Each hood shall be a high velocity water wash ventilator constructed in compliance with NFPA #96, BOCA, ICBO (Uniform Mechanical Code), SSBC and ACGIH (American Conference of Governmental Industrial Hygienists). The exhaust hoods shall be U.L. Listed and NSF approved. Exhaust hoods shall be constructed in the size, shape, and arrangement shown on drawing and equipment schedule, measuring overall approximately 2134 mm long x 914 mm wide and 914 mm high. Exhaust hoods shall be complete with high velocity grease extractors, plenum fire dampers, duct collars, make-up air plenums, hanger brackets, auto wash control panels, piping, and nozzles.

Exhaust hoods shall be constructed entirely of 18 gauge type #304 stainless steel with a #4 finish. All external seams and joints shall be welded liquid tight with all exposed welds ground smooth and polished back to original finish. Exhaust hoods shall be furnished with all necessary hanger rods and shall be suspended from building structure above and secured to building wall at rear. Hoods shall be supplied with stainless steel closure channels on front and sides as required to close the gap between the top of the exhaust hoods and the finished ceiling.

Hoods shall have the same extractor chambers, duct collars, fire dampers, thermostats, and make-up air plenums as specified for Item #39. Hoods shall have fluorescent lights as specified for Item #39, extending the full length of each hood. Each hood shall have a separate wash control panel flush mounted in the wall in the locations shown on plan. These hoods shall otherwise be in accordance with the manufacturer's standard specifications. Specifications are based on Avtec Model #AWWP exhaust hoods.

C11 FIRE SUPPRESSION SYSTEM:

Contractor Furnished, Contractor Installed.

Each exhaust hood, Item C10, shall be furnished with a separate liquid agent fire suppression system which shall be mounted on the wall near the ceiling in the locations shown on plan. No conduit or piping shall be exposed to view. Each fire suppression system shall be a U.L. Listed liquid agent, cartridge operated, regulated pressure system with a fixed nozzle agent distribution network. The systems shall be capable of automatic detection and actuation with local or remote manual actuation. Each fire suppression system shall be provided with a remote manual pull station recessed in the wall in locations shown on plan. The fire suppression systems shall be factory piped and complete with all necessary surface protection nozzles as required by Code. The systems shall be properly sized for the nozzles required. The extinguishing agent shall be a potassium carbonate, potassium acetate-based formulation designed for flame known down and securement of grease related fires. The regulated release mechanism shall be a spring loaded mechanical/pneumatic type with a nitrogen cartridge for providing the expellant gas supply to the liquid agent tanks. The regulated release mechanism shall contain a factory installed regulator set at 690 kPa. The mechanism shall have a visual indicator of the cocked or fired position without having to open the enclosure. The fire suppression systems shall have an automatic fusible link detection system. The fire suppression systems shall also have a microswitch to allow the shut-off of all gas and electricity for the items below the exhaust hood. Shut-off devices shall be furnished and installed under other sections of the specifications. All exposed piping for the fire

suppression systems shall be chrome plated or chrome sleeved. The fire suppression systems shall be installed in accordance with the Underwriter's Laboratories Listing, NFPA 96 and NFPA 17 and shall conform to all local authorities having jurisdiction over this fire suppression system. Upon completion of the installation of the fire suppression systems, a qualified fire suppression installer shall inspect the system and certify in writing that the systems meet all applicable Codes. Specifications are based on Ansul Model #R-102 systems.

C12 DEEP FAT FRYER:

Contractor Furnished, Contractor Installed.

One only Counter Model, w/Baskets, Side Mounted Basket Support Hook, w/On & Off Switch, Swing Up Heating Elements, Lift Out Fat Container, specifications are based on LANG MFR. CO. Model No. C-28, w/Legs.

C13 TOP/BOTTOM GRILL:

Contractor Furnished, Contractor Installed.

One only grill shall be electric Quartz Hood Heating Elements, w/Stainless Steel Adjustable Legs, w/Grease Drawer, Thermostat Knobs, 100-450xF Heating Range. Unit sits on Item # C8 Equipment Stand. Specifications are based on Lang Model XL-48.

C14 UNDERCOUNTER REFRIGERATOR:

Contractor Furnished, Contractor Installed.

One only refrigerator shall be for storage of Cold Foods, Self-contained, 2 Door, Reach-in, Pre-set Temperature Control, w/Shelves, Traulsen and Company Model RUC 2-32 WSC.

C15 MICROWAVE:

Contractor Furnished, Contractor Installed.

One only microwave oven shall measure 586 mm wide x 600 mm deep x 392 mm high with a .04 cubic meter stainless steel lighted cavity, 1400 watts of cooking power, digital time and power level display, 10 programming buttons and see through door. Provide with 1800 mm power cord and plug. Specification is based on Litton Microwaving Company Model LC-14EVP.

C16 FRONT COUNTER:

Contractor Furnished, Contractor Installed.

One only front counter Custom Built with stainless steel panel on all sides and front. See Schedule of Standard Details, Detail Nos. 4.03, 4.04A, 8.01. Tray slide to accommodate 355 mm x 457 mm tray.

C17 SANDWICH UNIT:

Contractor Furnished, Contractor Installed.

One only commercial, self-contained refrigerated base with salad top unit (0.13 cubic meter storage capacity) with bumpers and casters. Top shall be one-piece 16 gauge stainless steel with integral 76 mm sloped nosing on front and 152 mm high x 51 mm thick backsplash on rear. Each top end shall have one 12 gauge spline bar with alignment dowels for joining matching equipment. Top shall be supplied with one die-stamped raised rim opening for use with three 1/4 size pans, three 1/3 size pans. Opening to be supplied with removable 18 gauge stainless steel cover. Top to be insulated with 76 mm high-density insulation. One 13 mm thick by 254 mm wide composition cutting board shall be mounted on top. Cabinet interior shall be 22 gauge

stainless steel back and bottom. Exterior back and bottom shall be 18 gauge stainless steel. Hinged door shall be constructed with ABS interior liner and 22 gauge stainless steel exterior front. Unit shall be furnished with one epoxy-coated wire shelf and designed to maintain 36 degree to 40 degree F. Housing front to be fitted with 18 gauge stainless steel louvered panel. Unit shall be equipped with 1800 mm cord with NEMA 5-15P plug. Delfield, Model No. V18436-28.

C18 HOT FOOD TABLE (2-wells):
Contractor Furnished, Contractor Installed.

One only commercial, mobile heated serving unit with end frame assembly constructed from 12 gauge aluminized steel, 16 gauge aluminized steel channel posts and lateral braces. Full front panel, end panels, control panel and all other exposed surfaces constructed of 18 gauge polished stainless steel. Top shall be 16 gauge polished stainless steel reinforced with 14 gauge channels. Provide recessed mounted control panels. Two insulated (high density fiberglass) heated wells are deep drawn stainless steel. Each well shall be 305 mm by 508 mm by 165 mm deep with coved corners. Each well is thermostatically controlled between 80 and 200 degrees F on front face of unit. A signal light indicates each wells temperature cycling. Provide four 127 mm diameter heavy duty casters, two with brakes. Unit to include a 1800 mm cord with NEMA 6-15P electrical plug. Specification based on Carter-Hoffman Corporation Model CC-232.

C19 HOT DOG ROLLER GRILL WITH BUN WARMER:
Contractor Furnished, Contractor Installed.

One only counter top hot dog station measuring 584 mm wide x 445 mm deep x 267 mm high. Unit shall be equipped with dual heavy duty motors, stainless steel removable drip pans, dual three position cook and hold controls, chrome rollers, dual drive and contrrol system with sneeze guard and 1800 mm power cord with plug. Provide drawer type bun warmer measuring 584 mm x 502 mm deep x 273 mm high with 1800 mm power cord and plug. Specifications are based on a Star Manufacturing Company Model 25 hot dog roller, Model 25 SG sneeze guard and Model SST25 and bun warmer.

C20 SHELF PROTECTOR (SNEEZE GUARD):
Contractor Furnished, Contractor Installed.

One only shelf protectors shall be mounted to the top of the hot/grill counters, Item C16 as shown on the plan in Schedule of Standard Details at the end of this section. Each protector shelf shall be 2700 mm x 318 mm x 356 mm high. Protector shelves shall be mounted on 25 mm square stainless steel posts with the front posts angled back 76 mm at the top. Posts shall be secured to the counter top with concealed mounting bolts on the underside. Posts shall be sealed to the top. Each unit shall have a 241 mm wide full length stainless steel top shelf with all edges formed down square. Front of each protector shelf shall have a safety glass of 5mm thick clear plexiglass sneeze guard with stainless steel channel edging. The underside of the top shelf shall have a row of fluorescent lights extending the full length. Lights shall be complete with fluorescent tubes with clear plastic safety shields with end caps. Lights shall be wired 120-60-1 phase and shall have a remote switch mounted in the apron of the counter. Specifications are based on Atlas Set-n-Serve Model #PRCL-7 protector case with lights.

C21 TRAY SLIDE:
Contractor Furnished, Contractor Installed.

One only tray slide shall be custom fabricated in the size and arrangement as show on

plan and in Schedule of Standard Details at the end of this section. Tray slide shall be 1200 mm wide x 355 mm deep, mounted 864 mm A.F.F typical. The tray slides shall be constructed of 14 gauge stainless steel and shall be formed in the configuration shown in Schedule of Standard Details at the end of this section. The front vertical edge of the tray slides shall be highlighted to a #7 finish. The rear edge of the tray slides shall be formed up under the turned down edge of the top. The joint between the top and tray slide shall be tight and shall be neatly sealed the full length. The corners and ends of the tray slides shall be mitered as shown on the plan and details. The ends of the tray slides shall be welded closed. The tray slides shall be mounted to the body of the counters (Item #C28) with 152 mm high 14 gauge stainless steel brackets spaced 914 mm on center. Brackets shall be secured to the tray slide and counter base. Tray slides shall otherwise be constructed in accordance with Section 2 of the specifications.

C22 DISPLAY REFRIGERATOR (Drop-In):

Contractor Furnished, Contractor Installed.

One only display refrigerators shall each be a self contained air cooled unit wired 120-60-1 phase with a .5 k.w. compressor complete with 1800 mm cord and NEMA #5-20P plug. Each refrigerator shall measure overall 1219 mm wide x 610 mm deep x 1384 mm high. Each refrigerator shall have a refrigerated base and a refrigerated upper display structure. The top of each refrigerator shall be constructed of 16 gauge stainless steel with a 76 mm deep sloped nosing on front. The exterior sides of each base shall be equipped with finished 18 gauge stainless steel panels.

The upper refrigerated structure shall be 762 mm deep and shall be insulated with foamed-in-place polyurethane. Each upper display structure shall be supplied with 18 gauge stainless steel exterior sides. The front of each upper display structure shall be equipped with two tempered thermopane, self-closing, glass doors. Each upper display shall have stainless steel back with ABS material ends. Each upper refrigerated structure shall be equipped with four epoxy coated wire shelves. Each upper refrigerated structure shall be equipped with a blower coil mounted in the top of the unit with two coils and one low velocity fan. Each coil shall be equipped with a 20 gauge stainless steel cover.

Each display refrigerator shall be equipped with the manufacturer's standard equipment. Specifications are based on Delfield Model # 5248-S-30 refrigerators.

C23 CUP/LID DISPENSER:

Contractor Furnished, Contractor Installed.

One only dispenser shall be counter mounted to Item # C27 with concealed fasteners and sealed all around. Dispense Paper and Plastic Products for Carryout Service. Specification is based on SerVend Model CD4A-T.

C24 ICE DISPENSER:

Contractor Furnished, Contractor Installed.

One only ice dispenser shall each be a 114 kg manual fill counter top unit measuring overall 762 mm wide x 762 mm deep x 762914 mm high. Dispensers shall have a 20 gauge type 304 stainless steel exterior and a plastic bin interior with foamed in place urethane insulation. Ice dispensing shall result from a paddle wheel which lifts and agitates the ice. Ice bins shall have a push button for dispensing the ice and shall also be furnished with a water faucet attachment. Ice dispensers shall have no drain trough with grate. The dispensers shall have a stainless steel front panel in lieu of the standard plastic decor panel. Dispensers shall be mounted and sealed to counter top of beverage counters, Item C27. Ice dispensers shall be wired 120-60-1 phase and complete with

2440 mm cord and plug. Specifications are based on SerVend Model #M-250 dispensers.

C24a SODA DISPENSER:
Vendor Furnished, Vendor Installed.

C25 COFFEE MAKER/DISPENSER:
Contractor Furnished, Contractor Installed.

One only coffee dispenser shall be a two product liquid concentrate type dispenser measuring overall 432 mm wide x 533 mm deep x 775 mm high. Dispenser shall have a capacity of up to 340 liters of coffee per hour. Dispenser shall have a stainless steel exterior with a hinged door on the front and a drip trough. Dispenser shall hold two 2 liter bag-in-box containers of coffee concentrate. Dispenser shall have two faucets for continuous coffee flow and shall have adjustable coffee strength. Coffee dispenser shall be wired 208-60-1 phase. Specifications are based on a Moccomat (Douwe Egberts) Model Prestige K-72.

Furnished with the coffee dispenser and mounted in the base of the beverage container, Item C28, shall be a 38 liter water pre-heater, wired 120-60-1 phase. Water heater shall have a temperature range of 43° to 77°C and shall be preset at 49°C. Specifications are based on a Vanguard Model #6E730.

C26 RACK, CONDIMENT PACKS (9 BINS):
Contractor Furnished, Contractor Installed.

One only condiment pack racks shall each include the rack and containers. Each rack shall measure 457 mm long x 533 mm wide x 368 mm high. Each three tiered rack shall be constructed of polyethylene and shall accommodate and be furnished with three rows of three condiment bins, total of nine. Each condiment bin shall be constructed of polyethylene and shall measure 125 mm wide x 305 mm deep x 110 mm high. Each bin shall be mounted to the rack with a grooved ledge molded into the rear of each bin. The bins and racks shall be in black color. Specifications are based on Cambro Model #9R9.

C27 COUNTER, BEVERAGE/DISPLAY:
Contractor Furnished, Contractor Installed.

One only beverage counter built to Order as Per Plan, See Schedule of Standard Details, Detail No. 4.03, W/Tray Slide, with drain trough and drain line for use with Hot and Cold Beverage. Counter top to have extra reinforcing adjacent to cutout for Item # C22 and under all counter top equipment with significant loads. Coordinate location of Item # C40 within this counter unit.

C28 COUNTER, EQUIPMENT/CASHER:
Contractor Furnished, Contractor Installed.

One only equipment/cashier counter shall be custom fabricated in size, shape and arrangement as shown on plan and in Schedule of Standard Details at the end of this section. Counter shall be 2330 mm wide x 1524 mm deep x 914 mm high with a tray slide Item C21 attached. The top shall be constructed of 14 gauge stainless steel with a 51 mm square turn down edge on all sides. Top of counter shall be adequately braced to support the weight of equipment installed there.

Base of the counter shall be constructed of 18 gauge stainless steel and shall be enclosed on all sides. The ends of the counter shall be covered 18 gauge stainless steel plates. The front and rear sides of the counter below the tray slide mounts shall have a total of 4 hinged doors each side. Each door shall be insulated 18 gauge

stainless steel double pan construction with full height stainless steel piano hinges and recessed stainless steel pulls. The interior of the base shall have a full length 18 gauge stainless steel undershelf measuring 610 mm front to back. Sides of undershelf shall be formed up 38 mm square and shall be tack welded and sealed to the body. The rear edge of undershelf shall be formed up 152 mm high and tightly hemmed. Counter shall be mounted on 152 mm high x 41 mm diameter stainless steel legs with 50 mm adjustable stainless steel feet. Counter shall otherwise be constructed in accordance with Section 2 of the specifications.

C29 OVERSHELF:

Contractor Furnished, Contractor Installed.

One only 18 gauge stainless steel shelf with 14 gauge stainless steel brackets. Unit shall be mounted 1680 mm A.F.F. Specification is based on Duke Mfr. Co. Model No. MSD-2424

C30 REACH-IN REFRIGERATOR:

Contractor Furnished, Contractor Installed.

One only, self contained reach-in refrigerator with a net capacity of 1.46 cubic meters. Exterior cabinet shall be constructed of heavy gauge stainless steel with a # 4 finish and exterior flush mounted dial thermometer. Interior panels and door liners shall be stainless steel. Unit shall be furnished with four half length doors, six stainless steel shelves and 152 mm high stainless steel legs with 50 mm adjustable feet. Overall dimensions: 1473 mm wide x 889 mm deep x 2115 mm high. Specifications are based Trausen & Company Model RHT 2-32W UT.

C31 REACH-IN FREEZER:

Contractor Furnished, Contractor Installed.

One only, self contained reach-in freezer with a net capacity of 1.46 cubic meters. Exterior cabinet shall be constructed of heavy gauge stainless steel with a # 4 finish and exterior flush mounted dial thermometer. Interior panels and door liners shall be stainless steel. Unit shall be furnished with four half length doors, six stainless steel shelves and 152 mm high stainless steel legs with 50 mm adjustable feet. Overall dimensions: 1473 mm wide x 887 mm deep x 2134 mm high. Specifications are based Trausen & Company Model RLT 2-32W UT.

C32 TRAY SLIDE:

Contractor Furnished, Contractor Installed.

One only tray slide shall be custom fabricated in the size, shape and arrangement as shown on plan. Tray slide shall be an “L” shaped configuration and able to accommodate 356 mm x 457 mm trays. Tray slide shall have one leg 4760 mm wide x 355 mm deep, mounted 864 mm A.F.F and the other leg 3490 mm wide x 355 mm deep, mounted 864 mm A.F.F. with mitered corners. The tray slides shall be constructed of 14 gauge stainless steel and shall be formed in the configuration shown in Schedule of Standard Details at the end of this section. The front vertical edge of the tray slides shall be highlighted to a #7 finish. The rear edge of the tray slides shall be formed up under the turned down edge of counter top of Item #C27. The joint between the tops and tray slides shall be tight and shall be neatly sealed the full length. The ends of the tray slides shall be mitered as shown on the plan and details. The ends of the tray slides shall be welded closed. The tray slides shall be mounted to the body of the counters (Item C27) with 152 mm high 14 gauge stainless steel brackets spaced 914 mm on center. Brackets shall be secured to the tray slide and counter base. Tray slides shall

otherwise be constructed in accordance with Section 2 of the specifications.

C33 OPEN:

C34 CHUTE, HOT SANDWICH:
Contractor Furnished, Contractor Installed.

One only sandwich display warmer with dual slanted shelves should measure 914 mm wide x 610 mm deep x 686 mm high and shall be wired with 120V; single phase, 7.8 Amps and have an 1800 mm cord with a NEMA 5-15P plug. Unit shall be constructed of extruded aluminum and stainless steel with tempered glass end panels and incandescent lights to illuminate shelves. Shelves to have hardkote finish and display sign holders. Warmer will have an electronic temperature controller and a temperature monitor. Specification is based on a Hatco Model GRSDS-36.

C35 OVERSHELF:
Contractor Furnished, Contractor Installed.

One only wall shelf shall measure 457 mm wide x 610 mm deep x 254 mm high and configured as shown on the drawing. Shelf shall be constructed of 18 gauge stainless steel width with the front edge rolled down 38 mm square and the rear and ends formed up 25 mm. Each shelf shall be mounted to the wall 1829 mm A.F.F. Specifications are based on Duke Model MSD-1824.

C36 PIZZA WARMER/DISPLAY:
Contractor Furnished, Contractor Installed.

One only pizza display/warmer to measure 460 mm wide x 510 mm deep x 890 mm high wired for 120V, 60Hz, 12 Amps with 1800 mm cord with NEMA 5-15P plug. The stainless steel display cabinet has tempered glass sides with front & rear door access and an internal incandescent light. The unit shall have separate heat and humidity controls with a cabinet temperature monitor. Also included should be a four shelf multi-purpose rack. Specification based on Hatco Model #FDW-2.

C37 PASTRY DISPLAY:
Contractor Furnished, Contractor Installed.

One only self serve pastry display with front serve access. Constructed of clear acrylic, unit should measure 457 mm wide x 488 mm deep x 305 mm high and be able to hold two 330 mm x 427 mm trays on two shelves. Specification based on Hubert Display Fixtures Catalog Stock #74476.

C38 WARMER, TOPPING:
Contractor Furnished, Contractor Installed.

One only topping warmer measuring 440 mm wide x 220 mm deep x 210 mm high with twin food wells. Each well shall have thermostat and heating element. Unit shall have 4 quart insets or #10 cans and shall be wired 120V, 700 watts, 6 Amps with an 1800 mm cord with NEMA #5-15P electrical plug.
Specification is based on Vollrath Model #TW-24.

C39 NACHO CHIP WARMER/DISPLAY:
Contractor Furnished, Contractor Installed.

One only nacho chip display cabinet measuring 581 mm x 690 mm deep x 830 mm high. Cabinet shall have an 18 kg capacity with 2 doors. Unit shall be constructed of stainless steel and aluminum with tempered glass sides and doors. Cabinet shall be

wired 120V, single phase, 9. 9 Amps, with an 1800 mm cord wiith a NEMA #5-15P electrical plug. Specification is based on Hatco Model FST-1-MN.

C40 WATER TANK, PREHEATER (38 liters):
Contractor Furnished, Contractor Installed.

One only water preheater tank 400 mm wide x 400 mm deep x 581 mm high shall be a 38 liter water pre-heater, wired 120-60-1 phase. Water heater shall have a temperature range of 43° to 77°C and shall be preset at 49°C. Specifications are based on a Vanguard Model #6E730.

4.3 SCHEDULE OF STANDARD DETAILS

The following Standard Details are hereby made a part of these specifications and shall be utilized for reference design requirements.

Standard Detail	Title
1.01	Feild Joints & Assembly
1.02	Edges
1.02.1	Edges
1.04	Backsplashes
1.05	Table and Drainboard Framework
1.06	Counter Framework
1.06.1	Counter Framework
1.07	Table & Sink Legs
1.08	Counter Legs
1.09	Flange Foot
1.10	Crossbracing
1.10.1	Wall Support for Crossbracing
1.11	Undershelf
1.12	Overshelves & Support
1.13	Wall and Shelf Support
1.14	Drawers
1.16	Anti-Splash Drain Trough
1.18	Pot Racks
1.19	Cutting Board
1.29	Wall Mounted Receiving Desk
2.01	Worktable
2.02	Dishtable
2.03	Warewasher Connection and Table Trough
2.16	Wall Mounted Rack Overshelf
2.20	Pre-Rinse Sink Rack Slide
2.20.1	Pre-Rinse Sink Rack Slide
2.21	Curved Rack Guide
2.22	Dishtable Trough
2.30	Mobility Utility Table
3.01	Sinks & Drainboards
3.01.1	Sinks & Drainboards
3.01.2	Sinks & Drainboards
3.04	Counter Top Sink
4.01	Back Counter
4.01.1	Back Counter
4.02	Free Standing Counter
4.02.1	Free Standing Counter
4.03	Cafeteria Counters

*** SAFETY PAYS ***

4.04	Cafeteria Counter Tray Slides
4.06	Millwork Cafeteria Counter Front Paneled
4.15	Display Case
4.15.1	Display Case
4.16	Protector Case
4.16.1	Protector Case
5.06	Dishwasher Vent Duct
5.07	Condensate Hood
6.02	Floor Grate & Frame Detail
6.07	Wall Mounted Hose Station
7.01	Built-In Insulated Floor
7.02	Walk-In Refrigerator Light Installation
8.01	Wrapper Station

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION				CONTRACTOR										SPEC. SECTION 11400
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-04 Detail Drawings										
		1	Food Service Equipment; GA.										
			SD-09 Reports										
		2	Testing; FIO.										
			SD-19 Operation and Maintenance Manuals										
		3	Food Service Equipment; GA.										

***** SAFETY PAYS *****

***** SAFETY PAYS *****

SECTION 12380

DISPLAY/TROPHY CASE, MARKERBOARD, COAT HOOK PANEL

PART 1 GENERAL 12380-1
1.1 REFERENCE (Not Applicable) 12380-1
1.2 SUBMITTALS 12380-1
1.3 DELIVERY, STORAGE AND HANDLING 12380-1

PART 2 PRODUCTS 12380-1
2.1 MATERIALS 12380-1
2.2 FABRICATION 12380-3

PART 3 EXECUTION 12380-3
3.1 INSTALLATION 12380-3
--End of Section--- 12380-3

SECTION 12380

DISPLAY/TROPHY CASE, MARKERBOARD, COAT HOOK PANEL

PART 1 GENERAL

1.1 REFERENCE (Not Applicable)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Display/Trophy Case; FIO.

Bulletin Board; FIO.

Markerboard; FIO.

Manufacturer's Literature, materials description, catalog data and installation instructions.

1.3 DELIVERY, STORAGE AND HANDLING

Deliver, handle and store material at job site in such a manner as to prevent damage. Deliver in original unopened containers and store in clean dry area with temperature maintained above 10 degrees C, if conditions do not permit immediate installation.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Display/Trophy Case

Furnish and install in size indicated on drawings, Claridge Products and Equipment Inc. or approved equal.

2.1.1.1 Front

Bronze anodized finish (BA).

2.1.1.2 Back Panel

Designer fabric on 6.35mm duracore underlay. Fabric color: as indicated on finish schedule.

2.1.1.3 Shelves

254 mm width tempered glass.

2.1.1.4 Sliding Doors

6.35mm thick tempered glass.

2.1.1.5 Box

Oak grained finish, sides, top and bottom, 406mm depth (WB).

2.1.1.6 Lighting

Fluorescent fixtures at top of case, standard 110 current, wire in series and hard-wire to light box.

2.1.1.7 Mount

Mount as indicated on drawings with bottom edge 915mm above finished floor (AFF).

2.1.2 Markerboard

Furnish and install in size and location indicated on drawings, Claridge Products and Equipment, Inc. or approved equal.

2.1.2.1 Writing Surface

LCS porcelain enamel on 24 gauge steel.

2.1.2.2 Color of Marker Surface

As indicated on the drawings.

2.1.2.3 Panel Core

Particle board, 9.5mm thick with .38mm thick foil backing.

2.1.2.4 Accessories

Provide full-length marker tray and map rail.

2.1.2.5 Frame

Extruded aluminum

2.1.2.6 Dry Markers

Provide Dry Erase Kit, Claridge Products and Equipment, Inc. #LCS775 or equal for each markerboard. Kits are to include one set of 12 dry markers, as recommended by manufacturer, in colors red, blue, green and black (3 each), one bottle of markerboard cleaner and one marker eraser.

2.1.2.7 Mount

Mount where indicated on drawings with bottom edge 762mm above finished floor (AFF).

2.1.3 Coat Hook Panel

Furnish and install in style, size and location indicated on finish schedule, Vogel Peterson or approved equal, wall mount coat hook panels.

2.2 FABRICATION

Display/Trophy case, markerboard and coat hook panels shall be completely shop fabricated and shipped to the job site ready for easy assembly and installation.

PART 3 EXECUTION

3.1 INSTALLATION

Unless otherwise directed, assemble and install display/trophy case in accordance with manufacturer's instructions. Assemble and mount markerboard in accordance with manufacturers instructions. Wall mount coat hook panel behind entry door to offices and conference rooms if there is 152mm clearence between wall and door. Otherwise, wall mount beside entry door.

---End of Section---

SUBMITTAL REGISTER
(ER415-1-10)

CONTRACT NO.

TITLE AND LOCATION
DISCOM Barracks Complex Phase 1, Fort Campbell, KY

CONTRACTOR

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ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Display/Trophy Case; FIO.										
		2	Bulletin Board; FIO.										
		3	Markerboard; FIO.										

SAFETY PAYS

SECTION 12400

METAL CABINETS AND SHELVING
(Company Operations Building 7075 Only)

PART 1 GENERAL 12400-1
1.1 DESIGN 12400-1
1.2 SUBMITTALS 12400-1
1.3 DELIVERY AND STORAGE 12400-1

PART 2 PRODUCTS 12400-1
2.1 METAL SHELVING (Drawing Item 12400-1
2.2 ENCLOSED SHELVING UNIT(Drawing Item 12400-2
2.3 BULK STORAGE UNIT (Drawing Item 12400-2
2.4 BULK STORAGE UNIT (Drawing Item 12400-2
2.5 LOCKERS (Drawing Item 12400-2

PART 3 EXECUTION 12400-3
3.1 INSTALLATION 12400-3

PART 4 MANUFACTURERS 12400-3
--End of Section-- 12400-3

SECTION 12400

METAL CABINETS AND SHELVING
(Company Operations Building 7075 Only)

PART 1 GENERAL

1.1 DESIGN

Cabinets and shelving shall be constructed of steel and shall be factory fabricated, furnished in standard sizes, and produced by a manufacturer regularly engaged in the construction of metal cabinet and shelving units.

1.2 SUBMITTALS

Government approval is required for submittals with a “GA” designation; submittals having an a “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Metal Cabinets and Shelving; FIO.

Manufacturers printed data, catalog cuts, and installation instructions.

SD-04 Drawings

Metal Cabinets and Shelving; FIO.

Drawings showing plans, elevations, sections, construction details, thickness of members, methods of fastening, and hardware details. Information as needed to fully describe the metal cabinets and shelving and their installation into the work, and specifications for the required finish shall be included.

1.3 DELIVERY AND STORAGE

Metal cabinets and shelving shall be delivered to the site in undamaged condition, stored in fully covered areas, and protected from damage.

PART 2 PRODUCTS

Color of all exposed metal parts shall be Lyon Metal Products, color: “PP”, Putty or approved equal.

2.1 METAL SHELVING (Drawing Item “A”)

Overall dimensions of each unit shall be 915 mm wide X 460 mm deep X 2134 mm high, open style with 6 shelves per section. Units consist of 16 gauge, hot-rolled, formed “T” 38 mm X 54 mm. Uprights shall be punched on 38 mm centers with pairs of parallel slots 27 mm long, with one slot keyhole-shaped for bolting cross braces and accessories to uprights.

Shelves shall be 20-gauge with front and rear “Box W” formation. The front and rear “Box W” formation is not less than 30 mm X 21 mm X 29 mm with a 14 mm return flange, spot-welded to the bottom portion of the shelf. The 21 mm portion of the “Box W” formation shall have a 10-degree bend in the center for additional strength and rigidity. The front and rear flanges of the shelf shall be punched to accept bin fronts, label holders, and other accessories. Ends are to be flanged not less than 280 mm with a 90-degree return flange of not less than 16 mm. All corners shall be lapped and welded. All shelves shall be punched on 76 mm center for divider attachment.

Shelves shall also be punched at four corners for bolting to uprights. The front and rear flanges of the shelf are to be embossed with “20-gauge”.

Lateral cross braces shall be 25 mm X 12-gauge band formed and punched at each end to bolt to upright post. One pair of lateral cross braces to be used with every three shelving sections with shelf spacing less than 762 mm. Shelving sections with 762 mm or greater shelf spacing shall have two pairs of lateral cross braces with every three shelving sections.

2.2 ENCLOSED SHELVING UNIT(Drawing Item “B”)

Overall dimensions of units shall be 915 mm X 460 mm X 2134 mm high. Unit shall consist of one closed section of metal shelving. Each unit to have lockable, swinging doors.

Unit shall have 7 shelves per section. Shelves specifications shall be the same as for the shelves under “2.1 Metal Shelving”.

Closed uprights shall be 16-gauge, hot-rolled, formed “T 38 mm X 50 mm X 3 mm with 24-gauge side sheet spot-welded on 152 mm centers to the 13 mm extension of the .T”.

Backs to be 2 half panels of 24-gauge steel providing a total of three vertical rows of holes on 38 mm centers for attachment to shelves with back to shelf clips optional and with three screws at the top and bottom shelves, two at midpoint.

Swinging Doors shall be 20-gauge steel with one full-height 24-gauge pan reinforcement per door. Each pair of double swinging doors shall have three-point latching with turn handle capable of accepting padlock. One pair of double swinging doors to cover one full section of 914 mm wide shelving.

2.3 BULK STORAGE UNIT (Drawing Item “C”)

Size of Bulk Storage units shall be 1829 mm wide X 610 mm deep X 2134 mm high. Each section to have 3 storage levels.

Box post uprights shall be punched on 38 mm centers to accept either clip or bolt attachment. Each upright shall be 14-gauge with 12-gauge ladder braces.

Each section to have solid steel decking. Decking specification to be same as detailed in shelving specification under “2.1 Metal Shelving”.

Heavy-duty “Z” beams to be 91mm high with 862 kG. capacity per pair. Two front-to-back supports are required per level.

2.4 BULK STORAGE UNIT (Drawing Item “D”)

Size of units shall be 1829 mm wide X 915 mm deep X 2134 mm high.

Specifications shall be identical to specifications for Bulk Storage unit, Item “C”.

2.5 LOCKERS (Drawing Item “E” and “F”)

(See Specification 10505 Lockers and Benches)

PART 3 EXECUTION

3.1 INSTALLATION

Units have shared components when installed attached to each other as indicated on the drawings. Contractor shall be responsible for determining required starter and add-on components using manufacturers standard product.

Metal cabinets and shelving shall be installed in accordance with the manufacturers approved installation instructions and positioned in accordance with the drawings layout shown, set level, and secured in place to the building.

PART 4 MANUFACTURERS

Acceptable manufacturers, or approved equals, are:

1. Lyon Metal Products, Inc.
   P.O. Box 671
   Aurora, IL 60507-0671
   ph. 1-800-323-0096

2. Equipo
   4819 Maple Avenue
   Dallas, TX 75219
   ph. 214-443-9800

3. Penco Products, Inc.
   99 Brower Avenue
   P.O. Box 378
   Oaks, PA 19456-0378
   ph. 610-666-0500

--End of Section--

SUBMITTAL REGISTER
(ER415-1-10)

CONTRACT NO.

TITLE AND LOCATION
DISCOM Barracks Complex Phase 1, Fort Campbell, KY

CONTRACTOR

SPEC. SECTION
12400

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
		1	Metal Cabinets and Shelving; FIO.										
			SD-04 Drawings										
		2	Metal Cabinets and Shelving; FIO.										

***** SAFETY PAYS *****

SECTION 12540

WINDOW VENETIAN BLINDS
01/93

PART 1 GENERAL 12540-1
1.1 REFERENCES 12540-1
1.2 GENERAL 12540-1
1.3 SUBMITTALS 12540-1
1.4 DELIVERY AND STORAGE 12540-1

PART 2 PRODUCTS 12540-1
2.1 VENETIAN BLINDS 12540-2

PART 3 EXECUTION 12540-3
3.1 VENETIAN BLIND PLACEMENT 12540-3
3.2 INSTALLATION 12540-3
--END OF SECTION-- 12540-3

SECTION 12540

WINDOW VENETIAN BLINDS
01/93

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

FEDERAL SPECIFICATIONS (FS)

FS AA-V-00200 (Rev B) Venetian Blinds

1.2 GENERAL

Horizontal and vertical venetian blinds shall be provided as indicated, complete with necessary brackets, fittings, and hardware. Each window covering type utilized shall be a complete unit produced by one manufacturer. Equipment shall be mounted as indicated and shall be manually operated. The Contractor shall take measurements at the building and shall be responsible for the proper fitting and hanging of the equipment. Color shall be as shown on the color schedule drawings.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Venetian Blinds; FIO.

Drawings showing fabrication and installation details. The manufacturer's descriptive data will be acceptable, provided this literature accurately shows the items proposed to be furnished and the method of installation.

SD-14 Samples

Venetian Blinds; GA.

Color and texture shall be as indicated on the drawings color schedule Special Item Schedule. Blind slat shall be 150 mm in length for each color.

1.4 DELIVERY AND STORAGE

The Contractor shall be responsible for the receipt, storage, and handling of materials and supplies necessary to provide a complete installation. Venetian blinds shall be delivered to the project site in the manufacturer's original unopened containers. Materials shall be stored flat in a clean dry area with temperature maintained above 10 degrees C.

PART 2 PRODUCTS

2.1 VENETIAN BLINDS

Each blind, including hardware, accessory items, mounting brackets and fastenings, shall be provided as a complete unit produced by one manufacturer. All parts shall be one color and match the color of the blind slat. Steel features shall be treated for corrosion resistance.

2.1.1 Horizontal Venetian Blinds

Horizontal blinds shall conform to FS AA-V-00200, Type II (25.4 mm slats), except as modified below. Blind units shall be capable of nominally 180 degree partial tilting operation and full-height raising. Blinds shall be inside mount, made to fit between the jambs; slats shall be spring tempered aluminum not less than 0.203 mm thick; pulleys and gears in the operating mechanism shall be molded nylon, brass, steel or a combination of these materials.

2.1.1.1 Head Channel and Slats

Head channel shall be steel not less than 0.61 mm for Type II. Slats shall be aluminum, not less than 0.203 mm thick, and of sufficient strength to prevent sag or bow in the finished blind. A sufficient amount of slats shall be provided to assure proper control, uniform spacing, and adequate overlap.

2.1.1.2 Controls

The slats shall be tilted by a transparent tilting wand, hung vertically by its own weight, and shall swivel for easy operation. The tilter control shall be of enclosed construction. All moving parts and mechanical drive shall be made of compatible materials which do not require lubrication during normal expected life. The tilter shall tilt the slats to any desired angle and hold them at that angle so that any vibration or movement of ladders and slats will not drive the tilter and change the angle of slats. A mechanism shall be included to prevent over tightening. The wand shall be of sufficient length to reach to within 1500 mm of the floor.

2.1.1.3 Intermediate Brackets

Intermediate brackets shall be provided for installation of blinds over 1200 mm wide or over 2500 mm long and shall be installed as recommended by the manufacturer.

2.1.2 Vertical Blinds

Blind unit shall be capable of nominally 180 degree partial tilting operation autorotating and full stackback. The blinds shall be listed by the manufacturer as designed for extra hard use and severe service applications including heavy duty hardware. Vertical blinds shall be ceiling mounted with inside brackets. Blinds shall be floor length.

2.1.2.1 Vanes

Vanes shall be vinyl coated polyester yarns woven to produce openness factor of 1% for maximum strength and flexibility. Vanes shall hang without a chain. 88.9 mm vanes shall overlap not less than 10 mm.

2.1.2.2 Runners

Runners shall be provided to support each vane. Runners shall be of molded plastic and lubricated to operate smoothly and easily. The hook of the runner shall have an automatic latch to permit easy assembling and manual removing of the vane, and shall securely lock the vane for tilting and traversing.

2.1.2.3 Heading System

Heading system shall be not less than 1.19 mm thickness and shall be made of anodized aluminum alloy. The head shall extend the full width of the blind and each end shall be closed with an end cap. One cap shall contain

12540-2

the traversing and tilting controls. The opposite cap shall house the pulley for the traversing cord.

2.1.2.4 Valance

Vinyl valance shall be attached to the head by metal or plastic holders which grip the top and bottom edge of the valance and shall accept an insert of the same material as the slats . There shall be sufficient clearance behind the valance to permit the vanes to tilt without interference. The valance shall extend the full width of the blind. Returns shall be formed of a single piece valance where the end of the head is visible.

2.1.2.5 Controls

Tilting control and traversing controls shall hang compactly at the side light side of the blinds and shall reach within 1500 mm of the floor. The tilting control baton shall tilt all vanes simultaneously to any desired angle and hold them at that angle. A Zirlon or equal autorotate system shall be provided to rotate vanes to the open position when blinds are stacked open. The vanes shall traverse one way to the door side light side. The traversing control cord shall be minimum 1.78 mm in diameter with a minimum breaking strength of 623 N. The cord shall be anchored to a lead runner which shall be linked to all adjacent runners. The vanes shall be traversed along the head by pulling one side of the looped cord. A weighted pulley shall be provided at the bottom of the cord.

2.1.2.6 Connectors and Spacers

The connector shall be flexible, smooth and flat to slide unhindered when runners move independently of each other, and to nest compactly when runners are stacking. The length of the links shall relate to the vane width in order to equally space the traversing vanes, to maintain uniform and adequate overlap of vanes, and to fully cover the width of the opening.

2.1.2.7 Intermediate Brackets

Intermediate installation brackets shall be furnished for blinds over 1050 mm wide.

PART 3 EXECUTION

3.1 VENETIAN BLIND PLACEMENT

Horizontal and vertical venetian blinds shall be provided where indicated on finish schedule.

3.2 INSTALLATION

Installation shall be in accordance with the approved detail drawings and manufacturer's installation instructions. Units shall be level, plumb, secure, and at proper height and location relative to window units. The Contractor shall furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Installation shall not be initiated until completion of room painting and finishing operations. Upon completion of the installation, venetian blinds shall be adjusted for form and appearance, in proper operating condition, and free from damage or blemishes. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

--END OF SECTION--

12540-3

SUBMITTAL REGISTER (ER415-1-10)														CONTRACT NO.
TITLE AND LOCATION DISCOM Barracks Complex Phase 1, Fort Campbell, KY				CONTRACTOR										SPEC. SECTION 12540
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-04 Drawings										
		1	Venetian Blinds; FIO.										
			SD-14 Samples										
		2	Venetian Blinds; GA.										

SAFETY PAYS

SECTION 13080

SEISMIC PROTECTION FOR MECHANICAL, ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.70	(1981) Earthquake Actuated Automatic Gas Shutoff Systems

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1994a) Carbon Structural Steel
ASTM A 53	(1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 153	(1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
ASTM A 500	(1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 563	(1994) Carbon and Alloy Steel Nuts
ASTM A 603	(1988) Zinc-Coated Steel Structural Wire Rope
ASTM A 653	(1995) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM E 488	(1990) Strength of Anchors in Concrete and Masonry Elements
ASTM E 580	(1991) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Seismic Restraint

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.1	(1981; Supple 1991; R 1992) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

ICBO-099S94	(1994) Uniform Building Code

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION(SMACNA)

SMACNA-12	(1991; Appx E, 1993) Seismic Restraint Manual Guidelines for Mechanical Systems

UNDERWRITERS LABORATORIES (UL)

UL 1570	(1995) Fluorescent Lighting Fixtures
UL 1571	(1995) Incandescent Lighting Fixtures

1.2 SYSTEM DESCRIPTION

1.2.1 General

The requirements for seismic protection measures described in this section shall be applied to mechanical/electrical equipment and systems specified herein. Seismic protection requirements shall be in accordance with ICBO-099S94 using an importance factor of 1 and shall be provided in addition to any other requirements called for in other sections of these specifications. This facility shall be designed as being in seismic zone 2A; no other zone values shall be used to establish bracing requirements. Lateral support against earthquake induced forces shall be accomplished by positive attachments without consideration of friction resulting from gravity loads.

1.2.2 Mechanical/Electrical Equipment

Mechanical/electrical equipment shall include the following items to the extent required on the drawings or in other sections of these specifications:

Boilers	Cable Trays
Water Heaters	Expansion Air Separator Tanks
Water Chiller Units	Air and Refrigerant Compressors
Control Panels	Air Handling Units
Pumps with Motors	Water and Gas Piping
Light Fixtures	Panel Boards
Motor Control Centers	Transformers
Switchboards (Floor Mounted)	Suspended Ceiling Assemblies
Unit Heaters	Ducts
Exhaust and Return Fans	

1.2.3 Mechanical/Electrical Systems

The following mechanical and electrical systems shall be installed as required on the drawings and other sections of

these specifications and shall be seismically protected in accordance with this specification:

All Piping Inside the Building in Accordance With This Specification

Gas Distribution Systems

All Water Supply Systems

Storm and Sanitary Sewer Systems

1.2.4 NOT USED

1.2.5 Exclusion

Seismic protection of piping for fire protection systems shall be installed as specified in Sections 15330 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION.

1.2.6 Pipes and Ducts Requiring No Special Seismic Restraints

Seismic restraints may be omitted from the following installations:

a. Gas piping less than 25 mm (1 inch) inside diameter.

b. Piping in boiler and mechanical equipment rooms less than 32 mm (1-1/4 inches) inside diameter.

c. All other piping less than 38 mm (1-1/2 inches) inside diameter.

d. Electrical conduit less than 64 mm (2-1/2 inches) inside diameter.

e. Rectangular air handling ducts less than 0.37 square meters (4 square feet) in cross sectional area.

f. Round air handling ducts less than 457 mm (18 inches) in diameter.

g. Piping suspended by individual hangers 300 mm or less in length from the top of pipe to the bottom of the supporting structural member where the hanger is attached, except as noted below.

h. Ducts suspended by hangers 300 mm or less in length from the top of the duct to the bottom of the supporting structural member, except as noted below.

In exemptions g. and h. all hangers shall meet the length requirements. If the length requirement is exceeded by one hanger in the run, the entire run shall be braced.

1.2.7 All Other Interior Piping, Conduit, and Ducts

Interior piping, conduit, and ducts not covered by paragraphs Exclusion or Pipes and Ducts Requiring No special Seismic Restraints shall be seismically protected in accordance with the provisions herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for

information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Bracing and Coupling; GA.

Lighting Fixtures in Buildings; GA.

Miscellaneous Equipment; GA.

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

SD-04 Drawings

Bracing and Coupling; GA.

Flexible Couplings or Joints; GA.

Resilient Vibration Isolation Devices; GA.

Lighting Fixtures in Buildings; GA.

Miscellaneous Equipment; GA.

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

SD-13 Certificates

Flexible Ball Joints; FIO.

Flexible ball joints shall be certified to be suitable for the service intended by the manufacturer, based on not less than 2 years' satisfactory operation in a similar application.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall conform to the requirements specified below:

2.1.1 Bolts and Nuts

Squarehead and hexhead bolts, and heavy hexagon nuts, ASME B18.2.1, ASME B18.2.2, or ASTM A 307 for bolts and ASTM A 563 for nuts. Bolts and nuts used underground and/or exposed to weather shall be galvanized in accordance with ASTM A 153.

2.1.2 Sway Bracing

SAFETY PAYS

Material used for members listed in this section and on the drawings, shall be structural steel conforming with the following:

a. Plates, rods, and rolled shapes, ASTM A 36.

b. Wire rope, ASTM A 603.

c. Tubes, ASTM A 500, Grade B.

d. Pipes, ASTM A 53, Type E or S, Grade B.

e. Light gauge angles, less than 6 mm thickness, ASTM A 653.

2.1.3 Flexible Couplings

Flexible couplings shall have same pressure and temperature ratings as adjoining pipe.

2.1.3.1 Flexible Ball Joints

Flexible ball joints shall have cast or wrought steel casing and ball parts capable of 360-degree rotation plus not less than 15-degree angular movement.

2.1.3.2 Flexible Mechanical Joints

a. Mechanical couplings for steel or cast iron pipe shall be of the sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movement caused by expansion, contraction, slight settling or shifting of the ground, minor variations in trench gradients, and traffic vibrations. Where permitted in other sections of these specifications, joints utilizing split-half couplings with grooved or shouldered pipe ends may be used.

b. Sleeve-type couplings shall be used for joining plain-end pipe sections. The coupling shall consist of one steel middle ring, two steel followers, two gaskets, and necessary steel bolts and nuts to compress the gaskets. Underground bolts shall be high-strength type as specified above.

2.1.4 Lighting Fixture Supports

Fixture supports shall be malleable iron. Lighting fixtures and supports shall conform to UL 1570 or UL 1571 as applicable.

PART 3 EXECUTION

3.1 BRACING AND COUPLING

Bracing and coupling shall conform to the arrangements shown. Provisions of this paragraph apply to all piping within a 1.5 m line around outside of building unless buried in the ground. Piping grouped for support on trapeze-type hangers shall be braced at the same intervals as determined by the smallest diameter pipe of the group. No trapeze-type hanger shall be secured with less than two 13 mm (1/2 inch) bolts. Bracing rigidly attached to pipe flanges, or similar, shall not be used where it would interfere with thermal expansion of piping.

3.2 BUILDING DRIFT

Sway braces for a run shall not be attached to two dissimilar structural elements of a building that may respond differentially during an earthquake unless a flexible joint is provided. Joints capable of accommodating seismic displacements shall be provided where pipes pass through a building seismic or expansion joint, or where rigidly supported pipes connect to equipment with vibration isolators. For threaded piping, swing joints shall be provided. For piping with manufactured ball joints the seismic drift shall be 0.015 meters per meter of height above the base where the seismic separation occurs; this drift value shall be used in place of the expansion given in the manufacturer's selection table.

3.3 FLEXIBLE COUPLINGS OR JOINTS

3.3.1 Building Piping

Flexible couplings or joints in building piping shall be provided at bottom of all pipe risers larger than 90 mm (3-1/2 inches) in diameter. Flexible couplings or joints shall be braced laterally without interfering with the action of the flexible coupling or joint. Cast iron waste and vent piping need only comply with these provisions when caulked joints are used. Flexible bell and spigot pipe joints using rubber gaskets or no-hub fittings may be used at each branch adjacent to tees and elbows for underground waste piping inside of building to comply with these requirements.

3.3.2 Underground Piping

Underground piping and 100 mm (4 inch) or larger conduit, except heat distribution system, shall have flexible couplings installed where the piping enters the building. The couplings shall accommodate 76 mm of relative movement between the pipe and the building in any direction. Additional flexible couplings shall be provided where shown on the drawings.

3.4 PIPE SLEEVES

Pipe sleeves in interior non-fire rated walls shall be sized as indicated on the drawings to provide clearances that will permit differential movement of piping without the piping striking the pipe sleeve.

3.5 SPREADERS

Spreaders shall be provided between adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 100 mm apart. Spreaders shall be applied at same interval as sway braces at an equal distance between the sway braces. If rack type hangers are used where the pipes are restrained from contact by mounting to the rack, spreaders are not required for pipes mounted in the rack. Spreaders shall be applied to surface of bare pipe and over insulation on insulated pipes utilizing high-density inserts and pipe protection shields in accordance with the requirements of Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.6 ANCHOR BOLTS

3.6.1 Cast-In-Place

Floor or pad mounted equipment shall use cast-in-place anchor bolts, except as specified below. One nut shall be provided on each bolt. Anchor bolts shall conform to the following tabulation for the various equipment weights and specified seismic zone or the manufacturer's installation recommendations, whichever is the most stringent, unless otherwise shown on the drawings. Anchor bolts that exceed the normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

3.6.2 Minimum Bolt Sizes, Cast-In-Place Anchor Bolts

Max. Equip. Weight Kg	Minimum Bolt Sizes (mm)* Zone 4	Zone 3	Zone 2A	Zone 2B	Zone 1
225	13	13	13	13	13
450	13	13	13	13	13
2250	13	13	13	13	13
4500	13	13	13	13	13
9000	13	13	13	13	13
13500	16	13	13	13	13
22500	22	16	13	13	13
45000	**	**	16	22	13

*Based on four bolts per item, a minimum embedment of 12 bolt diameters, a minimum bolt spacing of 16 bolt diameters and a minimum edge distance of 12 bolt diameters. Equivalent total cross-sectional area shall be used when more than four bolts per item are provided. Anchor bolts shall conform to ASTM A 307. Anchor bolts shall have an embedded straight length equal to at least 12 times nominal diameter of the bolt.

**Equipment weighing more than 22,500 kgin Zones 3 and 4 shall have at least six bolts per item.

3.7 RESILIENT VIBRATION ISOLATION DEVICES

Selection of anchor bolts for vibration isolation devices and/or snubbers for equipment base and foundations shall follow the same procedure as in paragraph ANCHOR BOLTS except that an equipment weight equal to five times the actual equipment weight shall be used.

3.7.1 Resilient and Spring-Type Vibration Devices

Vibration isolation devices shall be selected so that the maximum movement of equipment from the static deflection point shall be 15 mm.

3.8 SWAY BRACES FOR PIPING

Sway braces shall be provided to prevent movement of the pipes under seismic loading. Braces shall be provided in both the longitudinal and transverse directions, relative to the axis of the pipe. The bracing shall not interfere with thermal expansion requirements for the pipes as described in other sections of these specifications.

3.8.1 Transverse Sway Bracing

Transverse sway bracing for steel and copper pipe shall be provided at intervals not to exceed those given in the tabulation below as modified for each seismic zone. All runs shall have a minimum of two transverse braces. Transverse sway bracing for pipes of materials other than steel and copper shall be provided at intervals not to exceed the hanger spacing as specified in Section 15400 PLUMBING, GENERAL PURPOSE.

3.8.2 Maximum Span for Transverse Sway Braces in Seismic Zone 4

Pipe Diameter	Std. Wgt. Steel Pipe - 40S	Ex. Strong Steel Pipe - 80S	Copper Tube Type L

SAFETY PAYS

(mm)	*L(m)	** F(kN)	*L(m)	**F(kN)	*L(m)	**F(kN)
25	6.7	0.30	6.7	0.4	3.4	0.08
40	7.6	0.60	7.9	0.8	3.7	0.16
50	8.8	1.0	9.1	1.3	4.3	0.30
65	9.8	1.7	10.0	2.1	4.8	0.50
80	10.4	2.5	10.7	3.2	5.2	0.70
90	11.0	3.3	11.6	4.1	5.5	1.0
100	11.9	4.3	12.2	5.3	5.8	1.3
125	12.5	6.4	13.4	8.5	6.1	2.1
150	13.7	9.4	14.0	12.2	6.7	3.3
200	14.9	16.6	16.5	22.9	7.9	6.9
250	16.5	27.1	18.0	34.1	8.5	11.7
300	17.7	38.1	18.6	46.0	9.4	17.6

*L = Maximum span between lateral supports multiplied by 1.1 for Zone 3, 1.25 for Zone 2A, 1.2 for Zone 2B, or 1.35 for Zone 1.

**F = Horizontal force on the brace multiplied by 0.8 for Zone 3, 0.5 for Zone 2A, 0.6 for Zone 2B, or 0.3 for Zone 1.

NOTE: Bracing shall consist of at least one vertical angle 50 x 50 mm x 16 gaugeand one diagonal angle of the same size.

3.8.3 Longitudinal Sway Bracing

Longitudinal sway bracing shall be provided at 12 m intervals except when the location of sway braces is shown on the drawings for the particular piping system. All runs shall have one longitudinal brace minimum. Sway braces shall be constructed in accordance with the drawings. Branch lines, walls, or floors shall not be used as sway braces.

3.8.4 Vertical Runs

Vertical runs of piping shall be braced at not more than 3 mvertical intervals. For tubing, bracing shall be provided at no more than 1.2 mspacing. Vertical braces shall be above the center of gravity of the span being braced. All sway braces shall be constructed in accordance with the drawings. Branch lines, walls, or floors shall not be used as sway braces.

3.8.5 Anchor Rods, Angles, and Bars

Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as specified below. Anchor rods, angles, and bars shall not exceed lengths given in the tabulation below.

3.8.6 Maximum Length for Anchor Braces

Type	Size (millimeters)	Maximum length* (meters)	Allowable Loads* (kilonewtons)
Angles	38 x 38 x 6	1.5	25.5
	50 x 50 x 6	2.0	34.5
	64 x 38 x 6	2.5	43.5

	75 x 64 x 6	2.5	48.0
	75 x 75 x 6	3.0	53.0
Rods	91	1.0	16.5
	22	1.0	22.0
Flat Bars	38 x 6	0.4	14.0
	50 x 6	0.4	18.0
	50 x 10	0.5	28.5
Pipes (40s)	25	2.0	18.0
	32	2.8	24.5
	40	3.2	29.5
	50	4.0	39.5

*Based on the slenderness ratio of l/r = 200 and ASTM A 36 steel, where l is the length of the brace and r is the least radius of gyration of the brace.

3.8.7 Clamps and Hangers

Clamps or hangers on uninsulated pipes shall be applied directly to pipe. Insulated piping shall have clamps or hangers applied over insulation in accordance with Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.8.8 Bolts

Bolts used for attachment of anchors to pipe and structure shall be not less than 13 mm (1/2 inch) diameter.

3.9 SWAY BRACES FOR DUCTS

3.9.1 Braced Ducts

Bracing details and spacing for rectangular and round ducts shall be in accordance with SMACNA-12, including Appendix E, using Seismic Hazard Level C.

3.9.2 Unbraced Ducts

Hangers for unbraced ducts shall be positively attached to the duct within 50 mmof the top of the duct with a minimum of two #10 sheet metal screws. Unbraced ducts shall be installed with a 150 mmminimum clearance to vertical ceiling hanger wires.

3.10 SWAY BRACES FOR CONDUIT

Conduit shall be braced as for an equivalent weight pipe.

3.11 EMERGENCY GAS SUPPLY CONNECTIONS

Facilities which are to be connected to natural gas distribution systems shall be provided with an aboveground locked, valved and capped emergency gas supply connection. Provisions shall be made for attachment of a portable, commercial-sized gas cylinder system to this connection. Connection shall be located within 300 mm of the exterior wall and clearly marked with an appropriate metal sign mounted on wall above. .

3.12 EQUIPMENT SWAY BRACING

3.12.1 Suspended Equipment

Equipment sway bracing shall be provided for items supported from overhead floor or roof structures. Braces shall consist of angles, rods, wire rope, bars, or pipes arranged as shown and secured at both ends with not less than 13 mm (1/2 inch) bolts. Braces shall conform to paragraph Maximum Length for Anchor Braces. Sufficient braces shall be provided for equipment to resist a horizontal force equal to 0.56 times the weight of equipment without exceeding safe working stress of bracing components. Details of equipment bracing shall be submitted for approval. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

3.12.2 Floor or Pad Mounted Equipment

3.12.2.1 Shear Resistance

Floor mounted equipment shall be bolted to the floor. Requirements for the number and installation of bolts to resist shear forces shall be in accordance with paragraph ANCHOR BOLTS.

3.12.2.2 Overturning Resistance

The ratio of the height of the equipment (measured from the base to the center of gravity of the equipment) to the minimum distance between anchor bolts shall be used to determine if overturning forces need to be considered in the sizing of anchor bolts. If this ratio is greater than 4.44 the bolt values in paragraph Minimum Bolt Sizes, Cast-In-Place Anchor Bolts shall not be used and calculations shall be provided to verify the adequacy of the anchor bolts for combined shear and overturning.

3.13 MISCELLANEOUS EQUIPMENT

3.13.1 Rigidly Mounted Equipment

The following specific items of equipment to be furnished under this contract shall be constructed and assembled to withstand a horizontal lateral force of 0.11 times the operating weight of the equipment, at vertical center of gravity of the equipment without causing permanent deformation, dislocations, separation of components, or other damage, which would render the equipment inoperative for significant periods of time following an earthquake.

Rigidly Mounted Equipment

Boilers
Chillers
Air-Handling Units
Transformers
Switch Boards and Switch Gears
Motor Control Centers
Free Standing Electric Motors

3.13.2 Nonrigid or Flexibly-Mounted Equipment

SAFETY PAYS

Nonrigid or flexibly-mounted items of equipment to be furnished shall be constructed and assembled to resist a horizontal lateral force of 0.225 times the operating weight of the equipment at the vertical center of gravity of the equipment.

3.14 LIGHTING FIXTURES IN BUILDINGS

Lighting fixtures and supports shall conform to the following:

3.14.1 Pendant Fixtures

Loop and hook or swivel hanger assemblies for pendant fixtures shall be fitted with a restraining device to hold the stem in the support position during earthquake motions. Pendant-supported fluorescent fixtures shall also be provided with a flexible hanger device at the attachment to the fixture channel to preclude breaking of the support. The motion of swivels or hinged joints shall not cause sharp bends in conductors or damage to insulation.

3.14.2 Recessed Fluorescent Fixtures

Recessed fluorescent individual or continuous-row mounted fixtures shall be supported by a seismic-resistant suspended ceiling support system and shall be fastened thereto at each corner of the fixture with bolts or approved clips; or shall be provided with fixture support wires attached to the building structural members using two wires for individual fixtures, attached to opposite corners, and one wire per unit of continuous row mounted fixtures. Each wire support shall be capable of supporting four times the weight of the fixture. Recessed lighting fixtures not over 25 kgin weight and suspended or pendant-hung fixtures not over 10 kgin weight may be supported by and attached directly to the ceiling system runners by a positive attachment such as screws or bolts, number and size as required by design seismic zone. Fixture accessories, including louvers, diffusers, and lenses shall have lock or screw attachments.

3.14.3 Assembly Mounted on Outlet Box

A supporting assembly that is intended to be mounted on an outlet box shall be designed to accommodate mounting features on 100 mm boxes, 75 mm plaster rings, and fixture studs.

3.14.4 Surface-Mounted Fluorescent Fixtures

Surface-mounted fluorescent individual or continuous-row fixtures shall be attached to a seismic-resistant ceiling support system. Fixture support devices for attaching to suspended ceilings shall be a locking-type scissor clamp or a full loop band that will securely attach to the ceiling support. Fixtures attached to underside of a structural slab shall be properly anchored to the slab at each corner of the fixture.

3.14.5 Wall-Mounted Emergency Light Unit

Each wall-mounted emergency light unit shall be secured to remain in place during a seismic disturbance.

3.14.6 Lateral Force

Light fixture bracing shall be designed to resist a lateral force of 0.56 times the fixture weight.

3.15 SUSPENDED CEILING ASSEMBLIES

The structural members of ceiling support systems, used primarily to support acoustical tile panels or acoustical panel lay-in tiles, with or without lighting fixtures, ceiling-mounted air terminals, and ceiling-mounted services, shall conform

to the following:

3.15.1 Design Loads

The main runners and cross-runners and their splices and intersection connections shall be designed for two times the design load or ultimate axial tension or compression (minimum 550 N (120 pounds)). The connections at the splices and intersections shall be of a mechanical interlocking type that cannot easily be disengaged. Ceiling structural systems shall be designed to withstand required vertical load as well as a lateral force of or 11.3 percent of the ceiling weight. The ceiling weight shall include all lighting fixtures and other equipment that are laterally supported by the ceiling and shall be not less than 200 Pa (4.0 psf). Exception: Ceiling areas of 13 square metersor less surrounded by walls that connect directly to the structure above will be exempt from the lateral-load standards of this specification.

3.15.2 Installation Requirements

Installation requirements shall be in accordance with ASTM E 580 except as follows:

3.15.2.1 Vertical Support

Hanger wires supporting a maximum tributary ceiling area of 1.5 square metersshall be a minimum of 10 gauge in diameter. The size of wires supporting a tributary ceiling area greater than 1.5 square metersshall be substantiated by design calculations. Hanger attachment devices used in ceiling systems not exceeding 200 Pa shall be capable of supporting a minimum allowable load of 1.3 kN (300 pounds). Hanger attachment devices used in ceiling systems exceeding 200 Pa shall be capable of supporting the design load and shall be substantiated by design calculations. If hangers must be splayed more than one horizontal to six vertical, the resulting horizontal force shall be offset by bracing or counter-splaying, and substantiated by design calculations.

3.15.2.2 Lateral Support

In lieu of the design criteria stated above, where ceiling loads do not exceed 200 Pa, lateral support for the ceiling system may be provided by four galvanized wires of minimum No. 12 gauge, as indicated in ASTM E 580, paragraph 4.4.6.

3.15.3 Lighting Fixture and Air Diffuser Supports

Lighting fixture and air diffuser supports shall be designed and installed to meet the requirements of equipment supports in the preceding paragraphs of this specification with the following exceptions:

a. Recessed lighting fixtures not over 25 kg in weight and suspended and pendent-hung fixtures not over 10 kg in weight may be supported and attached directly to the ceiling system runners by a positive attachment such as screws or bolts.

b. Air diffusers that weigh not more than 10 kg and that receive no tributary loading from ductwork may be positively attached to and supported by the ceiling runners.

--END OF SECTION--

SECTION 13080

SEISMIC PROTECTION FOR MECHANICAL, ELECTRICAL EQUIPMENT

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ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-01 Data										
			Bracing and Coupling; GA.										
			Lighting Fixtures in Buildings; GA.										
			Miscellaneous Equipment; GA.										
			SD-04 Drawings										
			Bracing and Coupling; GA.										
			Flexible Couplings or Joints; GA.										
			Resilient Vibration Isolation Devices; GA.										
			Lighting Fixtures in Buildings; GA.										
			Miscellaneous Equipment; GA.										
			SD-13 Certificates										
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***** SAFETY PAYS *****

SECTION 13110

CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)
11/97

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***** SAFETY PAYS *****

SECTION 13110

CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)
11/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 418	(1995a) Cast and Wrought Galvanic Zinc Anodes

NATIONAL ASSOCIATION OF CORROSION ENGINEERS (NACE)

NACE RP0169	(1996) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA TC 2	(1990) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996; Errata) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6	(1997) Rigid Metal Conduit
UL 510	(1994) Insulating Tape
UL 514A	(1996) Metallic Outlet Boxes

1.2 GENERAL REQUIREMENTS

1.2.1 Services of Corrosion Engineer

The Contractor shall obtain the services of a corrosion engineer to supervise and to inspect the installation of the cathodic protection system. Corrosion Engineer refers to a person, who, by reason of his knowledge of the physical sciences and the principles of engineering and mathematics, acquired by professional education and related practical experience, is qualified to engage in the practice of corrosion control on buried or submerged metallic piping systems and metallic tanks. Such person may be a licensed professional engineer or may be a person certified as being qualified by the National Association`of Corrosion Engineers if such licensing or certification includes suitable experience in corrosion control on buried or submerged metallic piping systems and metallic tanks. The corrosion engineer shall insure that the cathodic protection system is installed, tested, and placed into service in accordance with the requirements specified.

1.2.2 Rules

The installation shall conform to the applicable rules of NFPA 70.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Cathodic Protection System; FIO.

Manufacturer's Catalog Data.

Qualifications; GA.

Evidence of qualifications of the corrosion engineer.

SD-04 Drawings

Cathodic Protection System; GA.

Detail drawings consisting of a complete list of equipment and material including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Detail drawings shall contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function properly as a unit.

SD-09 Reports

Tests and Measurements; GA.

Test reports in booklet form tabulating all field tests and measurements performed, upon completion and testing of the installed system.

PART 2 PRODUCTS

2.1 ANODES

2.1.1 Magnesium Anodes

Magnesium anodes shall be Type II (D,E) corresponding to the applicable chemical composition listed in the following table:

PERCENT BY WEIGHT

ELEMENT	TYPE I	TYPE II	TYPE III	MG-MN ALLOY
Aluminum	5.0 - 7.0	5.3 - 6.7	5.3 - 6.7	0.010 Max.
Zinc	2.0 - 4.0	2.5 - 3.5	2.5 - 3.5	
Manganese	0.15 Min.	0.15 Min.	0.15 Min.	0.50 - 1.30

Copper	0.1 Max.	0.05 Max.	0.02 Max.	0.02 Max.
Silicon	0.30 Max.	0.30 Max.	0.10 Max.	
Iron	0.003 Max.	0.003 Max.	0.003 Max.	0.03 Max.
Nickel	0.003 Max.	0.003 Max.	0.002 Max.	0.001 Max.
Others	0.30 Max. or 0.30 Max.	0.30 Max.	0.30 Max.	0.05 each
Total Magnesium	Balance	Balance	Balance	Balance

2.1.2 NOT USED

2.1.3 Connecting Wire

Wire shall be No. 12 AWG solid copper wire, not less than 3 mlong, unspliced, complying with NFPA 70, Type TW insulation. Connecting wires for magnesium anodes shall be factory installed with the place of emergence from the anode in a cavity sealed flush with a dielectric sealing compound.

2.1.4 Artificial Backfill

Anodes shall be factory packaged with an artificial backfill in a water permeable fabric sack or cardboard container. Anodes shall be packaged on a vibrating platform to attain dense packing, and centering shall be assured by means of spacers.

Artificial backfill shall have the following composition:

Material	Approximate Percent by Weight
Gypsum	75
Bentonite	20
Sodium Sulfate	5
Total	100

2.2 MISCELLANEOUS MATERIALS

2.2.1 Electrical Wire

Wire shall be No. 12 AWG stranded copper wire with NFPA 70, Type TW insulation. Connecting wire splicing shall be copper compression connections made for the purpose or exothermic welds following instructions of the manufacturer. Split-bolt connections shall not be used.

2.2.2 Conduit

Rigid galvanized steel conduit and accessories shall conform to UL 6. Non metallic conduit shall conform to NEMA TC 2.

2.2.3 Test Boxes and Junctions Boxes

Boxes shall be outdoor type conforming to UL 514A.

2.2.4 Joint, Patch, Seal, and Repair Coating

Sealing and dielectric compound shall be a black, rubber based compound that is soft, permanently pliable, tacky, moldable, and unbacked. Compound shall be applied as recommended by the manufacturer, but not less than 12.7 mmthick.

Coating compound shall be cold-applied coal-tar base mastic.

Pressure-sensitive vinyl plastic electrical tape shall conform to UL 510.

2.2.5 Preformed Sheaths

Sheaths for encapsulating electrical wire splices to be buried underground shall fit the insulated wires entering the spliced joint.

2.2.6 Epoxy Potting Compound

Compound for encapsulating electrical wire splices to be buried underground shall be a two package system made for the purpose.

2.2.7 Test Stations

Test stations shall be complete with an insulated terminal block having the indicated number of terminals and shall be provided with a lockable cover and have a cast-in legend, "C.P. Test".

PART 3 EXECUTION

3.1 INSTALLATION

Unless otherwise indicated, all equipment shall be installed in accordance with the manufacturer's recommendations.

3.1.1 Anode Installation

Sizes and locations of anodes shall be determined by the corrosion engineer. Locations may be changed to clear obstructions if approved. . The anode connecting wire shall not be used for lowering the anode into the hole. The annular space around the anode shall be backfilled with fine earth in 150 mmlayers and each layer shall be hand tamped. Care must be exercised not to strike the anode or connecting wire with the tamper. Approximately 20 litersof water shall be applied to each filled hole after anode backfilling and tamping has been completed to a point about 150 mmabove the anode. After the water has been absorbed by the earth, backfilling shall be completed to the ground surface level.

a. Single anodes spaced as shown shall be direct connected to the pipeline, allowing adequate slack in the connecting wire to compensate for movement during backfill operation.

b. Groups of anodes in quantity shall be connected to a collector cable. The collector cable shall make contact with the structure to be protected only through a test station.

c. Resistance wires shall not be used to reduce the current output of individual or group anodes.

d. Connections to ferrous pipe or metal tanks shall be made by exothermic weld methods manufactured for the type of pipe or tank.

e. Electric arc welded connections and other types of welded connections to ferrous pipe and structures shall be approved before use.

3.1.2 Test Stations

Test stations shall be curb box mounted. Buried electrically insulating joints shall be provided with test wire connections brought to a test station.Test stations shall be located as follows:

a. At 300 m intervals or less.

b. Where the pipe or conduit crosses any other metal pipe.

c. At both ends of casings under roadways and railways.

d. Where both sides of an insulating joint are not accessible above ground for testing purposes.

3.2 CRITERIA OF PROTECTION

Criteria for determining the adequacy of protection on a buried pipe or tank shall be in accordance with NACE RP0169 and shall be selected by the corrosion engineer as applicable.

3.2.1 Iron and Steel

One of the following methods shall apply:

3.2.1.1 850 MV Negative Voltage

A negative voltage of at least minus 0.85 volt as measured between the pipe or tank and a saturated copper-copper sulfate reference electrode contacting the earth directly over the pipe or tank. Determination of this voltage shall be made with the cathodic system in operation.

3.2.1.2 300 MV Negative Voltage

A negative voltage shift of at least 300 millivolts as measured between the pipe or tank and a saturated copper-copper sulfate reference electrode contacting the earth directly over the pipe or tank. Determination of this voltage shift shall be made with the protective current applied. These criteria apply to pipes or tanks not in electrical contact with dissimilar metals.

3.2.1.3 100 MV Polarization Voltage

A minimum polarization voltage shift of 100 millivolts as measured between the pipe or tank and a saturated copper-copper sulfate reference electrode contacting the earth directly over the pipe or tank. This polarization voltage shift shall be determined by interrupting the protective current and measuring the polarization decay. When the protective current is interrupted, an immediate voltage shift will occur. The voltage reading, after the immediate shift, shall be used as the base reading from which to measure polarization decay.

3.2.2 Aluminum

Aluminum pipes or tanks shall under no circumstances be protected to a potential more negative than minus 1.20 volts, measured between the pipe or tank and a saturated copper-copper sulfate reference electrode contacting the earth, directly over the pipe or tank. Resistance, if required, shall be inserted in the anode circuit within the test station to reduce the potential of the aluminum pipe or tank to a value which will not exceed a potential more negative than minus 1.20 volts. Voltage shift criterion shall be one of the following:

3.2.2.1 150 MV Negative Voltage

A minimum negative voltage shift of 150 millivolts produced by the application of protective current. The voltage shift shall be measured between the pipe or tank and a saturated copper-copper sulfate reference electrode contacting the earth directly over the pipe or tank.

3.2.2.2 100 MV Negative Voltage

A minimum negative polarization voltage shift of 100 millivolts measured between the pipe or tank and a saturated copper-copper sulfate reference electrode contacting the earth, directly over the pipe tank. The polarization voltage shift shall be determined as outlined for iron and steel.

3.3 TESTS AND MEASUREMENTS

3.3.1 Baseline Potentials

After backfill of the pipe or tank and anodes is completed, but before the anodes are connected to the pipe or tank, the static potential-to-soil of the pipe or tank shall be measured. The locations of these measurements shall be identical to the locations specified for pipe- or tank- to-reference electrode potential measurements. The initial measurements shall be recorded.

3.3.2 Insulation Testing

Before the anode system is connected to the pipe or tank, an insulation test shall be made at each insulating joint or fitting. This test shall demonstrate that no metallic contact, or short circuit exists between the two insulated sections of the pipe or tank. Any insulating fittings installed and found to be defective shall be reported to the Contracting Officer.

3.3.3 Anode Output

As the anodes or groups of anodes are connected to the pipe or tank, current output shall be measured with an approved low resistance ammeter. The values obtained and the date, time, and location shall be recorded.

3.3.4 Pipe/Tank To Reference Electrode Potential Measurements

Upon completion of the installation and with the entire cathodic protection system in operation, electrode potential measurements shall be made using a copper-copper sulfate reference electrode and a potentiometer-voltmeter, or a direct current voltmeter having an internal resistance (sensitivity) of not less than 100,000 ohms per volt and a full scale of 1 or 2 volts. The locations of these measurements shall be identical to the locations used for the baseline potentials. The values obtained and the date, time, and locations of measurements shall be recorded.

3.3.5 Location of Measurements

3.3.5.1 Piping or Conduit

For coated piping or conduit, measurements shall be taken from the reference electrode located in contact with the earth, directly over the pipe. Connection to the pipe shall be made at service risers, valves, test leads, or by other means suitable for test purposes. Measurements shall be made at intervals not exceeding 120 m. In no case shall less than three measurements be made over any length of line. Additional measurements shall be made at each distribution service riser, with the reference electrode placed directly over the service line.

3.3.5.2 Tanks

For underground tanks measurements shall be taken from the reference electrode located:

a. Directly over the center of the tank.

b. At a point directly over the tank and midway between each pair of anodes.

c. At each end of the tank.

In no case shall less than three measurements be made.

3.3.6 Casing Tests

Casing tests before final acceptance of the installation, the electrical separation of carrier pipe from casings shall be tested and any short circuits corrected.

3.3.7 Interference Testing

Before final acceptance of the installation, interference tests shall be made with respect to any foreign pipes or tanks in cooperation with the owner of the foreign pipes or tanks. A full report of the tests giving all details shall be made.

3.3.8 Recording Measurements

All pipe/tank to soil potential measurements including initial potentials where required shall be recorded. The Contractor shall locate, correct and report to the Contracting Officer any short circuits to foreign pipes or tanks encountered during checkout of the installed cathodic protection system. Pipe/Tank to soil potential measurements are required on as many pipes or tanks as necessary to determine the extent of protection or to locate short-circuits.

3.4 PIPE JOINTS

3.4.1 Electrical Continuity

Underground pipe shall be electrically continuous except at places where electrically insulating joints are specified. Pipe joined by means other than welding shall meet electrical continuity requirements. The following mechanical joints that are not factory designed to provide electrical continuity shall be bonded by installing a metallic bond across the joint. The bonding connections shall be made by the exothermic welding process. Mechanical joints designed to provide electrical continuity shall meet manufacturer's published standards.

3.4.2 Coating

a. Mechanical joints and fittings of either the electrically conductive or insulating type shall be coated with an underground type dielectric coating system. Where external electrical continuity bonds are installed across mechanical joints, all bare or exposed metal, welds, bare wire and exposed coupling parts shall be coated with a coating system.

b. Couplings and fittings which have a low profile exterior designed to permit tape coating shall be primed and wrapped with an underground type pipe tape following recommendations of the coupling or fitting manufacturer.

c. Couplings and fittings that cannot be properly taped shall be enclosed in a spaced mold manufactured for the purpose and filled with cold applied dielectric compound.

3.5 ELECTRICAL ISOLATION OF STRUCTURES

3.5.1 Insulating Fittings

Insulating flanges and couplings shall be installed aboveground, or within manholes, wherever possible, but an insulating device that electrically separates a pipeline shall not be installed in a confined area where a combustible atmosphere may collect unless precautions are taken to prevent arcing such as by means of externally located lightning arresters, grounding cells, or other means. Insulating flanges and couplings in lines entering buildings shall be located at least 300 mmabove grade or floor level. Pipelines`entering buildings either below or above ground shall be electrically isolated from the structure wall with an electrically isolating gas tight wall sleeve.

3.5.2 Gas Distribution Piping

Electrical isolation shall be provided at each building riser pipe to the pressure regulator, at all points where a short circuit to another structure or to a foreign structure may occur, and at other locations as indicated.

3.5.3 Electrical Isolation

Electrical isolation shall be provided at each building entrance, and at other locations as indicated.
3.5.4 NOT USED

3.5.5 Copper Piping

Copper piping shall be electrically isolated at both ends of the pipe run.

3.6 DISSIMILAR METALS

3.6.1 Underground Dissimilar Piping

Buried piping of dissimilar metals including new and old steel piping, excepting valves, shall be electrically separated by means of electrically insulating joints at every place of connection. The insulating joint, including the pipe, shall be coated with an underground type dielectric coating for a minimum distance of 10 diameters on each side of the joint.

3.6.2 Underground Dissimilar Valves

Dissimilar ferrous valves in a buried ferrous pipeline, including the pipe, shall be coated with an underground type dielectric coating for a minimum distance of 10 diameters on each side of the valve. Brass or bronze valves shall not be used in a buried ferrous pipeline.

3.6.3 Aboveground Dissimilar Pipe and Valves

If the dissimilar metal pipe junction, including valves, is not buried and exposed to atmosphere only, the connection or valve, including the pipe, shall be coated with an underground type dielectric coating for a minimum distance of three diameters on each side of the junction.

3.7 CASING

Where a pipeline is installed in a casing under a roadway or railway, the pipeline shall be electrically insulated from the casing and annular space sealed against incursion of water.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION DISCOM Barracks Complex Phase 1, Fort Campbell, KY				CONTRACTOR									SPEC. SECTION 13110	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-01 Data										
		1	Cathodic Protection System; FIO.										
		2	Qualifications; GA.										
			SD-04 Drawings										
		3	Cathodic Protection System; GA.										
			SD-09 Reports										
		4	Tests and Measurements; GA.										

***** SAFETY PAYS *****

SAFETY PAYS

SECTION 13814

BUILDING PREPARATION FOR ENERGY MONITORING AND CONTROL SYSTEMS (EMCS)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(1988) Code for Electricity Metering

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME-18	(1971; Int. Supple 19.5-1972; Errata 1974) Fluid Meters, Their Theory and Application

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C57.13	(1993) Instrument Transformers

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(1993) Industrial Controls and Systems

1.2 GENERAL REQUIREMENTS

1.2.1 Preparation of Building for Interface

The Contractor shall provide all services, materials, and equipment necessary to prepare the building for interface to a future EMCS.

1.2.2 Environmental Conditions

All equipment shall be rated for continuous operation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally encountered at the installed location.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for

information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment and Performance; GA.

Six copies of the hardware and maintenance data, in manual format, bound in hardback, loose-leaf binders, within 30 days after completing the site testing. The contents of each manual shall be identified on the cover. The manuals shall include the names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and of the nearest service representatives for each item of equipment and each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies, to be submitted after completion of the site test, shall include all modifications made during installation, checkout, and acceptance.

Hardware data, shall describe all equipment provided, including:

a. General description and specifications.

b. Installation and checkout procedures.

c. Electrical schematics and layout drawings.

d. Alignment and calibration procedures.

e. Manufacturer's repair parts list indicating sources of supply, and National Stock Number when obtainable from the manufacturer.

f. Interface definition.

The maintenance data, shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

SD-04 Drawings

Equipment and Material; GA.

Detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall contain complete wiring, routing, and schematic diagrams. Drawings shall show proposed layout and installation of all equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-08 Statements

Test Plan; GA.

Six Copies of test plan and test procedure. Six Copies of test report that documents the test results, in booklet form. Test plan documents for the test, 120 days prior to the test. The test plan shall define all the tests required to ensure that the equipment meets technical and performance specifications. The test plan shall define milestones for the test exercises and shall identify the capabilities and functions to be tested.

Test Procedure; FIO.

Test procedure documents, 60 days prior to the test. Test procedures shall be developed from the test plans and design documentation. The procedures shall consist of detailed instructions for test setup, execution, and evaluation of test results. The procedures shall explain and shall detail, step by step, actions and expected results to demonstrate the requirements of this specification and the methods for simulating the necessary conditions of operation to demonstrate performance of the equipment. All test equipment to be used shall be furnished by the Contractor.

SD-09 Reports

Site Testing; FIO.

Test report, within 15 days after completion of the test. The test report shall be used to document results of the test.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Units of the same type of equipment shall be products of a single manufacturer.

2.2 ENCLOSURES

Enclosures shall conform to the requirements of NEMA 250 for the types specified. Finish color shall be the manufacturer's standard, unless otherwise indicated. Damaged surfaces shall be repaired and refinished using original type finish. Enclosures installed indoors shall be Type 12, or as shown. Equipment installed outdoors shall be housed in a Type 4 enclosure, unless otherwise shown.

2.3 NAMEPLATES

Laminated plastic nameplates shall be provided for all equipment furnished. Each nameplate shall identify the function, such as "mixed air controller" or "cold deck temperature sensor." Laminated plastic shall be 3 mm thick, white with black center core. Nameplates shall be a minimum of 25 by 75 mm, with minimum 6 mm high engraved block lettering. Nameplates for devices smaller than 25 by 75 mm shall be attached by a nonferrous metal chain. All other nameplates shall be attached to the equipment.

2.4 INSTRUMENTATION AND CONTROL (I&C) DIAGRAMS

Framed mylar drawings in laminated plastic shall be provided. Drawings shall show complete I&C diagrams for all equipment furnished and interfaces to all existing equipment, at each respective equipment location. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system manually shall be prepared in typed form, framed as specified for the I&C diagrams and posted beside the diagrams. Proposed diagrams, instructions, and other sheets shall be submitted prior to posting. The instructions shall be posted after completion of the Contractor's site testing. Provide a mylar reproducible of each I&C diagram in addition to the posted copy.

2.5 DATA TERMINAL CABINET (DTC)

Data terminal cabinet shall be provided for each mechanical room as an interface to the data environment (DE) instrumentation and controls. No instrumentation and control devices shall be located within the DTC.

2.5.1 Enclosure

The DTC shall be a separate metallic enclosure. The DTC shall be sized to accommodate the number of functions required by the control and monitoring devices as shown plus 25 percent expansion for each type of function provided.

2.5.2 Groupings

The DTC shall be divided into analog and digital groupings, each with separate sensor and control signal wiring raceways.

2.5.3 Terminal Strips

The DTC shall be provided with double sided screw type terminal strips. One side of the terminal strip shall be used for termination of field wiring from instrumentation and controls. The other side shall be used to connect the DTC to the future FID or MUX. Terminal strips shall have individual terminal identification numbers.

2.5.4 Power

A 120-Vac, 15-A, 60 Hz duplex outlet shall be provided within 1.8 mof each DTC.

2.6 INSTRUMENTATION AND CONTROL

2.6.1 Temperature Instruments

2.6.1.1 Resistor Temperature Detector (RTD)

RTDs shall be platinum with an accuracy of plus or minus 0.1 percent at 0.0 degrees C (32 degrees F) and shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper. Each RTD shall be furnished with an RTD transmitter specified and mounted integrally, unless otherwise shown.

2.6.1.2 Resistor Temperature Detector (RTD) Transmitters

The RTD transmitter shall be selected to match the resistance range of the platinum RTD. The transmitter shall produce a linear 4 to 20 mA dc output corresponding to the required temperature span. The output error shall not exceed 0.1 percent of calibrated span. The transmitter shall include offset and span adjustments unless the RTD element is integral to the transmitter and system calibration is provided.

2.6.1.3 Continuous Averaging RTDs

Continuous averaging RTDs shall have an accuracy of plus or minus 0.6 degree C at the reference temperature, and shall be of sufficient length to ensure that the resistance represents an average over the cross section in which it is installed. The sensor shall have a bendable copper sheath. Each averaging RTD shall be furnished with an RTD transmitter selected to match the resistance range of the averaging RTD. The transmitter shall produce a linear 4 to 20 mA dc output corresponding to the required temperature span. The output error of the transmitter shall not exceed 0.1 percent of the calibrated span. The transmitter shall include offset and span adjustments.

2.6.1.4 Temperature Switches

Temperature switches shall have a repetitive accuracy of plus or minus 1 percent of the operating ranges shown. Switch actuation shall be adjustable over the operating temperature range. The switch shall have a snap-action Form C contact

rated for the application.

2.6.1.5 Thermowells

Thermowells shall be monel, brass, or copper for use in copper water lines, wrought iron for measuring flue gases, and series 300 stainless steel for all other applications. The thermowell shall include a connection box, sized to accommodate the temperature transmitter.

2.6.2 NOT USED

2.6.3 Pressure Instruments

2.6.3.1 Pressure Transducers

Pressure transducers shall withstand up to 150 percent of rated pressure, with an accuracy of plus or minus 1 percent of full scale. The sensing element shall be either capsule, diaphragm, bellows, bourdon tube, or solid state. A transmitter located at the transducer shall be provided to convert the sensing element output to a linear 4 to 20 mA dc output corresponding to the required pressure span. The output error shall not exceed 0.1 percent of calibrated span. The transmitter shall include offset and span adjustments.

2.6.3.2 Pressure Switches

Pressure switches shall have a repetitive accuracy of plus or minus 5 percent of their operating range and shall withstand up to 150 percent of rated pressure. Sensors shall be diaphragm or bourdon tube. Switch actuation shall be adjustable over the operating pressure range. Switch shall have a snap-action Form C contact rated for the application. Gauge pressure switches shall have an adjustable differential setting.

2.6.4 Flow Instruments

2.6.4.1 through 2.6.4.3 NOT USED

2.6.4.4 Annular Pitot Tubes

Annular pitot tubes shall be averaging type differential pressure sensors with four total head pressure ports and one static port made of series 300 stainless steel. Sensor shall have an accuracy of plus of minus 2 percent of full flow.

2.6.4.5 NOT USED

2.6.4.6 NOT USED

2.6.4.7 Flow Switches

Flow switches shall have a repetitive accuracy of plus or minus 1 percent of its operating range. Switch actuation shall be adjustable over the operating flow range. The switch shall have a snap-action Form C contact rated for the application.

2.6.5 Electric Power Instruments

2.6.5.1 Potential Transformers

Potential transformers shall conform to IEEE C57.13.

2.6.5.2 Current Transformers

Current transformers shall conform to IEEE C57.13.

2.6.6 NOT USED

2.6.7 Output Devices

2.6.7.1 Control Relays

Control relay contacts shall be rated for the application, with a minimum of 2 sets of Form C contacts enclosed in a dust-proof enclosure. Relays shall be rated for a minimum life of one million mechanical operations. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage.

2.6.7.2 Time Delay Relays

Time delay relay contacts shall be rated for the application with a minimum of 2 sets of Form C contacts enclosed in a dust-proof enclosure. Relays shall be rated for a minimum life of one million mechanical operations. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage. Delayed contact opening or closing shall be adjustable from 1 to 60 seconds with a minimum accuracy of plus or minus 2 percent of setting.

2.6.7.3 Latching Relays

Latching relay contacts shall be rated for the application with a minimum of 2 sets of Form C contacts enclosed in a dust-proof enclosure. Relays shall be rated for a minimum life of one million mechanical operations. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage.

2.6.7.4 Reed Relays

Reed relays shall be encapsulated in a container housed in a plastic, epoxy, or metal case. Contacts shall be rated for the application. Operating and release times shall be 1 millisecond or less. Relays shall be rated for a minimum life of 10 million mechanical operations and shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage.

2.6.7.5 Contactors

Contactors shall be of the single coil, electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semipermanent magnets. Contacts shall be double-break silver-to-silver type protected by arcing contacts where necessary. Number of contacts and ratings shall be selected for the application. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage.

2.6.7.6 Solid State Relays

Input-output isolation shall be greater than 1000 megohms with a breakdown voltage of 1500 volts root mean square or

greater at 60 Hz. Relays shall be rated for a minimum life of 10 million operations. The ambient temperature range shall be at least minus 28.9 degrees C to plus 60.0 degrees C (minus 20 to plus 140 degrees F). Input impedance shall not be less than 500 ohms. Relays shall be rated for the application. Operating and release times shall be 1 millisecond or less. Transients shall be limited to 150 percent of control voltage. Solid state relays shall not be used on inductive loads which are switched on-off.

2.6.7.7 NOT USED

2.6.7.8 Single Input Control Point Adjustment (CPA) Controller

Single input CPA controllers shall permit changing of control points remotely by varying the CPA port value. CPA shall be plus or minus 10 percent of primary sensor span. Controllers shall operate from electronic or pneumatic sensors as shown. Controllers shall be complete with adjustable setpoint, adjustable gain (proportional band), and shall be field selectable for direct or reverse action. Pneumatic units provided shall be constructed to withstand a maximum pressure of 172 kPa. All controller inputs and outputs shall be provided with internal or external gauges or meters for calibration of input and output signals.

2.6.7.9 NOT USED

2.6.7.10 NOT USED

2.6.7.11 Motorized Potentiometers

Motorized potentiometers shall be reversible brushless alnico or samarium cobalt permanent magnet dc motors with rotary potentiometers coupled to the motor or gearhead output shaft. Motors shall be 22 mm (7/8 inch) diameter or larger, with a minimum rated life of 1,000 operating hours or 200,000 revolutions. Motors shall accept signals for clockwise rotation and counterclockwise rotation. With no signal present, the motor shall remain stationary. Rotary potentiometers shall be wirewound or conductive plastic, single or multiturn potentiometers with a minimum rated life of 200,000 revolutions. Potentiometers shall have a maximum resistance tolerance of plus or minus 10 percent and a maximum linearity tolerance of plus or minus 1 percent. Potentiometers shall be rated for a minimum of 1 watt at 52 degrees C (125 degrees F). Motorized potentiometers shall be housed in enclosures meeting both NEMA Type 4 and NEMA Type 13 ratings, and shall be suitable for operation at ambient temperatures of 1.7 degrees C to 48.9 degrees C (35 to 120 degrees F).

2.6.7.12 Potentiometer to Current Transducers

Potentiometer to current transducers shall have an accuracy of plus or minus 0.1 percent of span for 3-wire potentiometer inputs between 100 and 10,000 ohms full scale. Potentiometer transducers shall provide continuous span adjustments between 75 and 100 percent of the input range and continuous zero offset adjustment between 0 and 10 percent of the input range. Potentiometer transducers shall provide excitation current to the potentiometer and shall drive a 4 to 20 mA dc output signal, with 500 volts peak to peak isolation between input and output terminals. Potentiometer transducers shall be suitable for operation at ambient temperatures of minus 28.9 degrees C to plus 79.4 degrees C (minus 20 to 175 degrees F).

2.6.8 Position Sensors

2.6.8.1 End (Limit) Switches

Limit switches shall be of the sealed or enclosed type as required for the application. Contacts shall be snap-action Form C rated for the application.

2.6.8.2 Potentiometers

Potentiometers may be either rotary or linear, depending on the application of each position indicator. Position potentiometers shall have a linearity of plus or minus 5 percent and shall indicate position on a percent open basis.

2.6.9 Key Operated Switches

Hand-off-automatic (HOA), off-automatic, and all similar-use switches shall be key operated with all switches keyed alike. All switches shall be rated for a minimum of 600 Vac, 5-A, and shall be mounted in an enclosure as specified or shown. An auxiliary set of contacts rated for at least 120 Vac, 1 ampere shall be provided with each switch.

2.7 WIRE AND CABLE

The Contractor shall provide all wire and cable from the sensors and control devices in the DE to the DTCs.

2.7.1 Control Wiring

2.7.1.1 Digital Functions

Control wiring for digital functions shall be No. 18 AWG minimum with 600-volt insulation. Multiconductor wire shall have an outer jacket of Polyvinyl Chloride (PVC).

2.7.1.2 Analog Functions

Control wiring for analog functions shall be No. 18 AWG minimum with 600-volt insulation, twisted and shielded, 2-, 3-, or 4-wire to match analog function hardware. Multiconductor wire shall have an outer jacket of PVC.

2.7.2 Sensor Wiring

Sensor wiring shall be No. 20 AWG minimum twisted and shielded, 2-, 3-, 4-wire to match analog function hardware. Multiconductor wire shall have an outer jacket of PVC.

2.7.3 Class 2 Low Energy Conductors

The conductor types and sizes specified for digital and analog functions shall take precedence over any requirements for Class 2 low energy remote control and signal circuit conductors specified elsewhere.

2.8 RACEWAY SYSTEMS

Raceway systems from the sensors and control devices in the DE to the DTCs shall be provided by the Contractor.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

The Contractor shall install all components and appurtenances in accordance with the manufacturer's instructions and as shown or specified. All necessary interconnections, services, and adjustments required to prepare the building for interface to an EMCS shall be furnished. All wiring, including low voltage wiring, shall be installed in metallic raceways. All other electrical work shall be in accordance with Section 16415 and as shown. Instrumentation grounding as necessary to preclude ground loops and noise from adversely affecting equipment operations shall be

installed.

3.2 I/O SUMMARY TABLES

I/O Summary Tables shall be used in conjunction with the drawings to identify the hardware required for each building and system.

3.3 EQUIPMENT INSTALLATION

3.3.1 Temperature Instruments

3.3.1.1 Resistor Temperature Detector (RTD)

When the RTD is installed in pipes or is susceptible to corrosion and vibration, the RTD shall be installed in a thermowell. RTDs which are attached to surfaces shall be clamped or bonded in place. The surface shall be thoroughly cleaned, degreased, and after RTD installation, shall be insulated from ambient temperature effects. RTDs used for space temperature sensing shall include a housing suitable for wall mounting. RTDs used for OA sensing shall have an instrument shelter to minimize solar effects, and shall be mounted to minimize building effects. RTD assemblies shall be readily accessible and installed in a manner as to allow easy replacement.

3.3.1.2 Temperature Switches

Temperature switches shall be installed as specified for RTDs. Temperature switches shall be adjusted to the proper setpoint and shall be verified by calibration. Switch contact ratings and duty shall be selected in accordance with NEMA ICS 1.

3.3.2 NOT USED

3.3.3 Pressure Instruments

3.3.3.1 Pressure Sensors

Pressure sensors (all types) installed on liquid lines shall have drains. Pressure sensors installed on steam lines shall have drains and siphons. All pressure sensors shall have valves for isolation, venting, and taps for calibration. Pressure sensors shall be verified by calibration. Differential pressure sensors shall have nulling valves.

3.3.3.2 Pressure Switches

Pressure switches (all types) installed on liquid lines shall have drains. Pressure sensors installed on steam lines shall have drains and siphons. All pressure switches in water and steam lines shall have valves for isolation, venting, and taps for calibration. Pressure switches shall be adjusted to the proper setpoint, and shall be verified by calibration. Pressure switches shall be mounted higher than the process connection. Differential pressure switches shall have nulling valves. Switch contact ratings and duty shall be selected in accordance with NEMA ICS 1.

3.3.4 Flow Instruments

3.3.4.1 through 3.3.4.4 NOT USED

3.3.4.5 Annular Pitot Tubes

Annular pitot tubes shall be installed so that the total head pressure ports are set-in-line with the pipe axis upstream and the static port facing downstream. The total head pressure ports shall extend diametrically across the entire pipe. Annular pitot tubes shall not be used wherever the flow is pulsating or where pipe vibration exists.

3.3.4.6 NOT USED

3.3.4.7 NOT USED

3.3.4.8 Flow Switches

Flow switches shall be installed in such a manner as to minimize any disturbance in the flow of fluid while maintaining reliable operation of the switch.

3.3.5 Electric Power Devices

3.3.5.1 Potential Transformers

Potential transformers shall be installed in new cabinets as shown.

3.3.5.2 Current Transformers

Current transformers shall be installed in new cabinets as shown.

3.3.6 NOT USED

3.3.7 Output Devices

3.3.7.1 Relays and Contactors

Relays and contactors shall be installed in new cabinets.

3.3.7.2 NOT USED

3.3.7.3 Controllers

Controllers shall be installed in new control cabinets or as shown.

3.3.8 Position Sensors

3.3.8.1 End (Limit) Switch

Limit switch type and mounting shall be properly suited for the application to provide reliable switch operation.

3.3.8.2 Potentiometers

Potentiometer type and mounting shall be properly suited for the application to provide reliable operation.

3.3.9 NOT USED

3.3.10 Enclosures

SAFETY PAYS

All enclosure penetrations shall be from the bottom and shall be sealed to preclude entry of water using a silicone rubber sealant.

3.4 SITE TESTING

Site testing and adjustment of all equipment shall be performed in accordance with approved test procedures. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. Test reports shall be submitted as specified.

--END OF SECTION--

SECTION 13814

BUILDING PREPARATION FOR ENERGY MONITORING AND CONTROL SYSTEMS

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SUBMITTAL REGISTER (ER415-1-10)	CONTRACT NO.
TITLE AND LOCATION Discom Barracks Complex, Phase I Ft. Campbell, Kentucky	CONTRACTOR
	SPEC. SECTION 13814

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-01 Data										
			Equipment and Performance; GA.										
			SD-04 Drawings										
			Equipment and Material; GA.										
			SD-08 Statements										
			Test Plan; GA.										
			Test Procedure; FIO.										
			SD-09 Reports										
			Site Testing; FIO.										

SAFETY PAYS

SECTION 15250

THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. At the discretion of the government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 580	(1995) Stainless and Heat Resisting Steel Wire
ASTM A 641	(1992) Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM B 209	(1995) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 195	(1990) Mineral Thermal Insulating and Cement
ASTM C 449	(1995) Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 518	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 533	(1985; R 1990) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 534	(1994) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(1995) Mineral Fiber Pipe Insulation
ASTM C 552	(1991) Cellular Glass Thermal Insulation
ASTM C 553	(1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 612	(1993) Mineral Fiber Block and Board Thermal Insulation

ASTM C 647	(1995) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C 795	(1992) Thermal Insulation for Use in Contact With Austenitic Stainless Steel
ASTM C 871	(1995) Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions
ASTM C 916	(1985; Rev 1990) Adhesives for Duct Thermal Insulation
ASTM C 920	(1994) Elastomeric Joint Sealants
ASTM C 921	(1989 R; 1996) Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM C 1126	(1989) Specification for faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
ASTM D 3278	(1989) Test Methods for Flash Point of Liquids by Setaflash Closed-Cup Apparatus
ASTM E 84	(1995a) Surface Burning Characteristics of Building Materials
ASTM E 96	(1995) Water Vapor Transmission of Materials

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGSINDUSTRY (MSS)

MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA-01	(1993) National Commercial & Industrial Insulation Standards

1.2 SYSTEM DESCRIPTION

Field-applied insulation and accessories on mechanical systems shall be as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated. Field applied insulation materials required for use on Government-furnished items as listed in the SPECIAL CONTRACT REQUIREMENTS shall be furnished and installed by the Contractor.

1.3 GENERAL QUALITY CONTROL

1.3.1 Standard Products

Materials shall be the standard products of manufacturers regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.3.2 Installer's Qualifications

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.3.3 Surface Burning Characteristics

Unless otherwise specified, insulation not covered with a jacket shall have a flame spread rating no higher than 75 and a smoke developed rating no higher than 150. The outside surface of insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50. Insulation materials located exterior to the building perimeter are not required to be fire-rated. Flame spread and smoke developed ratings shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material that shall be used in the actual construction. Jackets shall comply with the flame spread and smoke developed ratings of 25/50 as determined by ASTM E 84.

1.3.4 Identification of Materials

Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-14 Samples

Thermal Insulation Materials; GA.

A complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories for each mechanical system requiring insulation shall be included. Materials furnished under this section of the specification shall be submitted at one time.

After approval of materials and prior to applying insulation a booklet shall be prepared and submitted for approval. The booklet shall contain marked-up MICA-01 plates (or detail drawings showing the insulation material and insulating system) for each pipe, duct, or piece of equipment which is/are required to be insulated per this specification. The MICA plates shall be marked-up showing the materials to be installed in accordance with the requirements of this specification for the specific insulation application. The Contractor shall submit all MICA Plates required to show the entire insulating system, including Plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. If the Contractor elects to submit detailed drawings instead of marked-up MICA Plates, the detail drawings shall show cut-away, section views, and details indicating each component of the insulation system and showing provisions for insulating jacketing, and sealing portions of the equipment. For each type of insulation installation on the drawings, provide a label which identifies each component in the installation (i.e., the duct, insulation, adhesive, vapor retarder, jacketing, tape, mechanical fasteners, etc.) Indicate insulation by type and manufacturer. Three copies of the booklet shall be submitted at the jobsite to the Contracting Officer. One copy of the

approved booklet shall remain with the insulation Contractor's display sample and two copies shall be provided for Government use.

After approval of materials actual sections of installed systems properly insulated in accordance with the specification requirements shall be displayed. Such actual sections must remain accessible to inspection throughout the job and will be reviewed from time to time for controlling the quality of the work throughout the construction site. Each material used shall be identified, by indicating on an attached sheet the specification requirement for the material and the material by each manufacturer intended to meet the requirement. Display sample sections will be inspected at the jobsite by the Contracting Officer. Approved display sample sections shall remain on display at the jobsite during the construction period. Upon completion of construction, the display sample sections will be closed and sealed.

Pipe Insulation Display Sections: Display sample sections shall include as a minimum an elbow or tee, a valve, dielectric unions and flanges, a hanger with protection shield and insulation insert, or dowel as required, at support point, method of fastening and sealing insulation at longitudinal lap, circumferential lap, butt joints at fittings and on pipe runs, and terminating points for each type of pipe insulation used on the job, and for hot pipelines and cold pipelines, both interior and exterior, even when the same type of insulation is used for these services.

Duct Insulation Display Sections: Display sample sections for rigid and flexible duct insulation used on the job. A display section for duct insulation exposed to weather shall be protected by enclosing with a temporary covering.

1.5 STORAGE

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants by the Contractor. Insulation material and supplies that become dirty, dusty, wet, or otherwise contaminated may be rejected by the Contracting Officer.

PART 2 PRODUCTS

2.1 GENERAL MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following:

2.1.1 Adhesives

2.1.1.1 NOT USED

2.1.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C 195.

2.1.1.3 Lagging Adhesive

Lagging adhesives shall be nonflammable and fire-resistant and shall have flame spread and smoke developed ratings of 25/50 when measured in accordance with ASTM E 84. Adhesives shall be either the Class 1 or Class 2 type as defined here. Class 1 adhesive shall be pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for

sealing edges of and bounding fibrous glass tape to joints of fibrous glass board; or for bonding lagging cloth to thermal insulation. Class 2 adhesive shall be pigmented white and be suitable for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations.

2.1.2 Contact Adhesive

Adhesive may be dispersed in a nonhalogenated organic solvent with a low flash point (flash point less than minus 3.9 degrees C when tested in accordance with ASTM D 3278) or, dispersed in a nonflammable organic solvent which shall not have a fire point below 94 degrees C. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not omit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 100 degrees C. The adhesive shall be nonflammable and fire resistant.

2.1.3 Caulking

ASTM C 920, Type S, Grade NS, Class 25, Use A.

2.1.4 Corner Angles

Nominal 0.4060 mm (0.016 inch)aluminum 25 by 25 mm (1 by 1 inch) with factory applied kraft backing. Aluminum shall be ASTM B 209, Alloy 3003, 3105, or 5005.

2.1.5 Finishing Cement

Mineral fiber hydraulic-setting thermal insulating cement ASTM C 449.

2.1.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth and glass tape shall have flame spread and smoke developed ratings of no greater than 25/50 when measured in accordance with ASTM E 84. Fibrous glass cloth and tape; 20 by 20 maximum size mesh. Tape shall be 100 mmwide rolls. Class 3 tape shall be 0.15 kg per square meter.

2.1.7 Staples

Outward clinching type ASTM A 167, Type 304 or 316 stainless steel.

2.1.8 Jackets

ASTM C 921, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 6.1 N/mm (35 pounds/inch) width. ASTM C 921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 3.5 N/mm (20 pound/inch) width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.1.8.1 White Vapor Retarder ASJ (All Service Jacket)

For use on hot/cold pipes, ducts, or equipment. Vapor retarder jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.1.8.2 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.4060 mm (0.016 inch) nominal thickness; ASTM B 209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105 with factory applied moisture retarder. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.3960 mm (0.015 inch) thick, 12.7 mm (1/2 inch) wide for pipe under 300 mm (12 inch) diameter and 19.1 mm (3/4 inch) wide for pipe over 300 mm (12 inch) diameter. Aluminum jacket circumferential seam bands shall be 50.8 by 0.4060 mm (2 by 0.016 inch) aluminum matching jacket material. Bands for insulation below ground shall be 19.1 by 0.5080 mm (3/4 by 0.020 inch) thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburg or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.1.8.3 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance with minimum thickness 0.7620 mm (0.030 inch). Insulation under PVC jacket shall meet jacket manufacturer's written recommendations.

2.1.9 Vapor Retarder Coating

The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall not exceed 0.05 perm and shall be determined according to procedure B of ASTM E 96 utilizing apparatus described in ASTM E 96. The coating shall be a nonflammable, fire resistant type. The flash point of the compound shall not be less than 26.7 degrees C and shall be determined in accordance with ASTM D 3278. All other application and service properties shall be in accordance with ASTM C 647.

2.1.10 Wire

Soft annealed ASTM A 580 Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

2.2 PIPE INSULATION MATERIALS

Pipe insulation materials shall be as follows:

2.2.1 Aboveground Cold Pipeline

Insulation for minus 34 degrees C to plus 16 degrees C shall be as follows:

2.2.1.1 Cellular Glass

ASTM C 552, Type II, and Type III.

2.2.1.2 Flexible Cellular Insulation

ASTM C 534, Type I or II. Type II shall have vapor retarder skin on both sides of the insulation.

2.2.1.3 Phenolic Insulation

ASTM C 1126, Type III. A maximum allowable leachable chloride content shall comply with ASTM C 795 when tested in accordance with ASTM C 871.

2.2.2 Aboveground Hot Pipeline

For aboveground hot pipeline above 16 degrees C insulation the following requirements shall be met.

2.2.2.1 Mineral Fiber

ASTM C 547, Class 1 or Class 2 as required for the operating temperature range.

2.2.2.2 Calcium Silicate

ASTM C 533, Type I indoor only, or outdoors above 121 degrees C (250 degrees F) pipe temperature.

2.2.2.3 Cellular Glass

ASTM C 552, Type II and Type III.

2.2.2.4 Flexible Cellular Insulation

ASTM C 534, Type I or II to 93 degrees C (200 degrees F) service.

2.2.2.5 Phenolic Insulation

ASTM C 1126 Type III to 121 Cservice. A maximum allowable leachable chloride content shall comply with ASTM C 795 when tested in accordance with ASTM C 871.

2.2.3 Below ground Pipeline Insulation

ASTM C 552, Type II.

2.3 DUCT INSULATION MATERIALS

Duct insulation materials shall be as follows:

2.3.1 Rigid Mineral Fiber

ASTM C 612, Class 1.

2.3.2 Flexible Mineral Fiber

ASTM C 553, Type I, Class B-2.

2.3.3 Cellular Glass

ASTM C 552, Type I.

2.3.4 Phenolic Foam

ASTM C 1126 Type II. A maximum allowable leachable chloride content shall comply with ASTM C 795 when tested in accordance with ASTM C 871.

2.3.5 Flexible Cellular

ASTM C 534 Type II.

2.4 EQUIPMENT INSULATION MATERIALS

Equipment insulation materials shall be as follows:

2.4.1 Cold Equipment Insulation

For temperatures below 16 degrees C.

2.4.1.1 Cellular Glass

ASTM C 552, Type I, Type III, or Type IV as required.

2.4.1.2 Flexible Cellular Insulation

ASTM C 534, Type II.

2.4.1.3 Not Used

2.4.2 Hot Equipment Insulation

For temperatures above 16 degrees C.

2.4.2.1 Rigid Mineral Fiber

ASTM C 612, Type 2, 3, 4 or 5 as required for temperature encountered to 982 degrees C (1800 degrees F).

2.4.2.2 Flexible Mineral Fiber

ASTM C 553, Type 1, 2, 3, 4, 5, 6, or 7 as required for temperature encountered to 649 degrees C (1200 degrees F).

2.4.2.3 Calcium Silicate

ASTM C 533, Type I, indoors only, or outdoors above 121 degrees C (250 degrees F).

2.4.2.4 Cellular Glass

ASTM C 552, Type I, Type III, or Type IV as required.

2.4.2.5 Flexible Cellular Insulation

ASTM C 534, Type II, to 93 degrees C (200 degrees F).

2.4.2.6 Phenolic Foam

ASTM C 1126 Type II to 121 degrees C (250 degrees F). A maximum allowable leachable chloride content shall comply with ASTM C 795 when tested in accordance with ASTM C 871.

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if aforementioned cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA-01 standard plates except where modified herein or on the drawings.

3.1.2 Fire stopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with Fire stopping materials as specified in Section 07270 FIRE STOPPING.

3.1.3 Painting and Finishing

Painting shall be as specified in Section 09900 PAINTING, GENERAL.

3.1.4 Flexible Cellular Insulation

Flexible cellular insulation shall be installed with seams and joints sealed with a contact adhesive. Flexible cellular insulation shall not be used on surfaces greater than 93 degrees C (200 degrees F). Seams shall be staggered when applying multiple layers of insulation. Insulation exposed to weather and not shown to have jacketing shall be protected with two coats of UV resistant finish as recommended by the manufacturer after the adhesive is dry.

3.1.5 Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.6 Pipes/Ducts/Equipment which Require Insulation

Insulation is required, unless stated otherwise, on all pipes, ducts, or equipment, which operate at or below 15.6 C and at or above 26.7 C.

3.2 PIPE INSULATION INSTALLATION

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3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

a. Pipe used solely for fire protection.

b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.

c. Sanitary drain lines.

d. Unions in pipe above 16 degrees C.

e. Strainers in pipe above 16 degrees C.

f. Check valves in pipe above 16 degrees C.

g. Air chambers.

3.2.1.2 Pipes Passing Through Sleeves

a. Pipe insulation shall be continuous through the sleeve.

b. An aluminum jacket with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.

c. Where penetrating interior walls, the aluminum jacket shall extend 50 mm beyond either side of the wall and shall be secured on each end with a band.

d. Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 250 mm above the floor with one band at the floor and one not more than 25 mm from the end of the aluminum jacket.

e. Where penetrating waterproofed floors, the aluminum jacket shall extend from below the backup material to a point 50 mm above the flashing with a band 25 mm from the end of the aluminum jacket.

f. Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 50 mm beyond the interior surface of the wall.

g. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, aluminum jackets shall be utilized. Pipe insulation to the 1.5 m level shall be protected.

3.2.1.3 Pipes Passing Through Hangers

a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 50 mm (2

inches)and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 50 mm (2 inches) shall be installed.

b. Horizontal pipes larger than 50 mm (2 inches) at 16 degrees C (60 degrees F) and above shall be supported on hangers in accordance with MSS SP-69, and Section 15400 PLUMBING, GENERAL PURPOSE.

c. Horizontal pipes larger than 50 mm (2 inches) below 16 degrees Cshall be supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-69. An insulation insert of cellular glass or calcium silicate shall be installed above each shield. The insert shall cover not less than the bottom 180 degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 50 mm on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 25 mm (1 inch), wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

d. Vertical pipes shall be supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-69 covering the 360 degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360 degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 50 mm on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 25 mm (1 inch), wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation as an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 9 m, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe which are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.

e. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 38 mm, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible cellular insulation shall conform to ASTM C 921, Type 1, and is allowed to be of a different material than the adjoining insulation material.

3.2.1.4 Flexible Cellular Pipe Insulation

Flexible cellular pipe insulation shall be tubular form for pipe sizes 150 mm (6 inches) and less. Type II sheet insulation used on pipes larger than 150 mm (6 inches) shall not be stretched around the pipe. On pipes larger than 300 mm (12 inches), adhere insulation directly to the pipe on the lower 1/3 of the pipe. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation.

3.2.2 Aboveground Cold Pipelines

The following shall be included for aboveground cold pipelines minus 34 degrees C to plus 16 degrees C:

a. Domestic cold and chilled drinking water.

b. Make-up water.

c. Refrigerant suction lines.

d. Chilled water.

e. Dual temperature water, i.e. HVAC hot/chilled water.

f. Air conditioner condensate drains.

3.2.2.1 Insulation Thickness

Table A
Cooling Systems Pipe Diameter (mm)

Service or Range of Temperature (degrees C)	Run-outs* up to 51 mm	25 mm & less	32 to 51 mm	64 to 102 mm	127 to 152 mm	203 mm & larger
4.4 - 12.8	13	13	19	25	25	25
less than 4.4	25	25	38	38	38	38

Thicknesses are based on insulation having thermal conductivity in the range of of 0.033 to 0.035 Watts/(meter degree C) when measured at 24 C.

Table I - Cold Piping Insulation Thickness
Pipe Size (mm)

Type of Service	Material	Runouts up to 51 mm*	25 mm & less	32 - 51 mm	64 - 102 mm	127 - 152 mm	203 mm & larger
Refrigerant suction piping	CG		38	38	38	38	38
	FC		25	25	25	25	25
Chilled water supply & return & dual temp piping	CG	38	38	38	51	51	51
	FC	13	25	25	25	25	25
Cold domestic water, above and below ceilings	CG	38	38	38	38	38	38
	FC	10	10	10	10	10	10
Exposed lavatory drains, exposed domestic water	FC	13	13	13	13	19	19
	MF	13	25	25	38	38	38

piping & drains to areas for handicap personnel						
Air conditioning condensate drain located inside building	FC	10	13	13	N/A	N/A

*When runouts to terminal units exceed 3.66 m the entire length of runout shall be insulated like the main feed pipe.

LEGEND:

CG - Cellular Glass
CS - Calcium Silicate
MF - Mineral Fiber
FC - Flexible Cellular

3.2.2.2 Jacket for Fibrous, Cellular Glass, and Insulated Pipe

Insulation shall be covered with a factory applied vapor retarder jacket or field applied seal welded PVC jacket. Insulation inside the building required to be protected with an aluminum jacket shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, aluminum jackets shall be utilized. Pipe insulation to the 1.5 m level will be protected.

3.2.2.3 Insulation for Straight Runs (Fibrous and Cellular Glass)

a. Insulation shall be applied to the pipe with joints tightly butted. The ends of fibrous insulation shall be sealed off with vapor retarder coating at intervals not to exceed 4.5 m.

b. Longitudinal laps of the jacket material shall overlap not less than 38 mm. Butt strips 75 mm (3 inches) wide shall be provided for circumferential joints.

c. Laps and butt strips shall be secured with adhesive and stapled on 100 mm (4 inch) centers if not factory self-sealing.

d. Factory self-sealing lap systems may be used when the ambient temperature is between 4 degrees C (40 degrees F) and 50 degrees C (120 degrees F) during installation. The lap system shall be installed in accordance with manufacturer's recommendations. Stapler shall be used only if specifically recommended by the manufacturer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.

e. All Staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor retarder coating. All seams, except those on factory self-seal systems shall be coated with vapor retarder coating.

f. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating with vapor retarder coating. The patch shall extend not less than 38 mm past the break.

g. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor retarder coating.

3.2.2.4 Insulation for Fittings and Accessories

a. Pipe insulation shall have ends thoroughly coated with a vapor retarder coating not less than 150 mm from each flange, union, valve, anchor, or fitting in all directions.

b. Precut, preformed insulation for placement over fittings, flanges, unions, valves, anchors, and mechanical couplings shall be used. Precut, preformed insulation shall exhibit the same properties as the adjoining pipe insulation. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation should be overlapped 50 mmor one pipe diameter. Loose fill mineral fiber or insulating cement shall be used to fill the voids. Elbows insulated using segments shall not have less than 3 segments per elbow.

c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with two coats of vapor retarder coating with a minimum total thickness of 1.6 mm (1/16th inch), applied with glass tape embedded between coats. Tape seams shall overlap 25 mm. The coating shall extend out onto the adjoining pipe insulation 50 mm.

d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 150 mm flexible cellular insulation, unless otherwise indicated.

f. Insulation shall be marked showing the location of unions, strainers, and check valves.

3.2.2.5 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same thickness as adjoining pipe insulation and the insulation shall be protected with one coat of vapor retarder coating under the PVC cover. The covers shall be secured by PVC vapor retarder tape, adhesive, seal-welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

3.2.3 Aboveground Hot Pipelines

For hot pipelines above 16 degrees C the following shall be included:

a. Domestic hot water.

b. Hot water heating.

3.2.3.1 Insulation Thickness

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Table B
Thickness of Pipe Insulation for Pipes Handling Steam and Fluids Other Than Domestic Hot Water (mm)

Fluid Temperature Range (C)	Insulation Conductivity: Conductivity Range W/(mK)	Mean Rating Temperature C	Runouts* up to 51	Nominal Pipe Diameter (mm): 25 & less	32 to 51	64 to 102	127 to 152	203 & lgr
above 177	0.046 - 0.049	121	38	64	64	76	89	89
122 - 177	0.042 - 0.045	93	38	51	64	64	89	89
94 - 121	0.039 - 0.043	66	25	38	38	51	51	89
61 - 93	0.036 - 0.042	52	13	38	38	38	38	38
41 - 60	0.035 - 0.040	38	13	25	25	25	38	38
Domestic and Service Hot Water Systems								
> 41	0.035 - 0.040	38	13	25	25	38	38	38

* When runouts to terminal units exceed 3.66 m, the entire length of runout shall be insulated like the main feed pipe.

Insulation thickness for hot pipelines shall be determined using Table II.

Table II - Hot Piping Insulation Thickness
Pipe Size (mm)

Type of Service (degrees C)	Material	Runouts up to 51 mm	25 mm & less	32 - 51 mm	64 - 102 mm	127 - 152 mm	203 mm & larger
Hot domestic water supply & recirculating system (93.3 C max)	CG	38	38	38	38	38	38
	FC	13	25	25	38	38	38
	PF	13	25	25	25	25	25
	MF	13	25	25	38	38	38
Heating hot water, supply & return (121.1 C max)	CG	38	38	51	51	51	64
	PF	13	25	25	25	25	38
	MF	13	38	38	51	64	76
	CS	25	38	51	64	64	64

*When runouts to terminal units exceed 3.66 m, the entire length of runout shall be insulated like the main feed pipe.

LEGEND:

PF - Phenolic Foam
CG - Cellular Glass
CS - Calcium Silicate
MF - Mineral Fiber
FC - Flexible Cellular

3.2.3.2 Jacket for Insulated Pipe

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type II jacket or field applied aluminum where required or seal welded PVC.

3.2.3.3 Insulation for Straight Runs

a. Insulation shall be applied to the pipe with joints tightly butted.

b. Longitudinal laps of the jacket material shall overlap not less than 38 mm,and butt strips 75 mm (3 inches) wide shall be provided for circumferential joints.

c. Laps and butt strips shall be secured with adhesive and stapled on 100 mm centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed.

d. Factory self-sealing lap systems may be used when the ambient temperature is between 4 degrees C and 49 degrees C (40 degrees and 120 degrees F) and shall be installed in accordance with manufacturer's instructions. Laps and butt strips shall be stapled whenever there is nonadhesion of the system. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.

e. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and be secured with adhesive and stapled on 100 mm centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed. Patch shall extend not less than 38 mm past the break.

f. Install flexible cellular pipe insulation by slitting tubular sections and applying onto piping or tubing. Alternately, whenever possible, slide unslit sections over the open ends of piping or tubing. All seams and butt joints shall be secured and sealed with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Insulation shall be pushed on the pipe, never pulled. Stretching of insulation may result in open seams and joints. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives must be used. Type II sheet insulation when used on pipe larger than 150 mm (6 inches) shall not be stretched around the pipe. On pipes larger than 300 mm (12 inches),adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

3.2.3.4 Insulation for Fittings and Accessories

a. The run of the line pipe insulation shall have the ends brought up to the item.

b. Insulation of the same thickness and conductivity as the adjoining pipe insulation, either premolded or segmented, shall be placed around the item abutting the adjoining pipe insulation, or if nesting size insulation is used, overlapping 50 mm or one pipe diameter. Loose fill mineral fiber or insulating cement shall be used to fill the voids. Insulation for elbows less than 80 mm (3 inch) size shall be premolded. Insulation for elbows 80 mm (3 inch) size and larger shall be either premolded or segmented. Elbows insulated using segments shall have not less than 3 segments per elbow. Insulation may be wired or taped on until finish is applied.

c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with two coats of Class 1 adhesive applied with glass tape embedded between coats. Tape seams shall overlap 25 mm. Adhesive shall extend onto the adjoining insulation not less than 50 mm. The total dry film thickness shall be not less than 1.6 mm (1/16 inch).

d. Insulation terminations shall be tapered to unions at a 45-degree angle.

e. At the option of the Contractor, factory premolded one- or two-piece PVC fitting covers may be used in lieu of the adhesive and embedded glass tape. Factory premolded segments or factory or field cut blanket insert insulation segments shall be used under the cover and shall be the same thickness as adjoining pipe insulation. The covers shall be secured by PVC vapor retarder tape, adhesive, seal-welding or with tacks made for securing PVC covers.

3.2.4 Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, an aluminum jacket shall be applied. PVC jacketing requires no factory applied jacket beneath it. Flexible cellular insulation exposed to weather shall be treated in accordance with paragraph FLEXIBLE CELLULAR INSULATION.

3.2.4.1 Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 50 mm at longitudinal and circumferential joints and shall be secured with bands at not more than 300 mm centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 16 degrees Cand below shall be sealed with caulking while overlapping to prevent moisture penetration. Where jacketing on piping 16 degrees Cand below abuts an uninsulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 16 degrees Cshall be sealed with a moisture retarder.

3.2.4.2 Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of an emulsion type weatherproof mastic recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 25 mmand the adjoining aluminum jacket not less than 50 mm. Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be used with PVC lagging and adhesive welded moisture tight.

3.2.4.3 PVC Lagging

PVC lagging shall be ultraviolet resistant and adhesive welded vapor tight with manufacturer's recommended adhesive. Installation shall include provision for thermal expansion.

3.3 DUCT INSULATION INSTALLATION

Except for oven hood exhaust duct insulation, corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket.

3.3.1 Duct Insulation Thickness

Table III - Minimum Duct Insulation (mm)

Cold Air Ducts	50
Relief Ducts	38
Fresh Air Intake Ducts	38
Warm Air Ducts	50
Relief Ducts	38
Fresh Air Intake Ducts	38

3.3.2 Insulation and Vapor Retarder for Cold Air Duct

Insulation and vapor retarder for cold air duct below 16 degrees C: Ducts and associated equipment shall be insulated to a thickness which is in accordance with Table III. The following shall be insulated:

a. Supply ducts.

b. Return air ducts.

c. Relief ducts.

d. Flexible runouts (field-insulated).

e. Plenums.

f. Duct-mounted coil casings.

g. Fresh air intake ducts.

h. Combustion air intake ducts.

i. Exhaust ducts where noted.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 12 kg per cubic meter (3/4 pcf) and rigid type where exposed, minimum density 48 kg per cubic meter (3 pcf). Insulation for round/oval ducts shall be flexible type, minimum density 12 kg per cubic meter (3/4 pcf) with a factory Type I jacket; or, a semi rigid board, minimum density 48 kg per cubic meter (3 pcf), formed or fabricated to a tight fit, edges beveled and joints tightly butted and staggered, with a factory applied Type I all service jacket. Insulation for exposed ducts shall be provided with either a white, paintable, factory-applied Type I jacket or a vapor retarder jacket coating finish as specified. Fibrous and cellular glass insulation on concealed duct shall be provided with a factory-applied Type I vapor retarder jacket. The total dry film thickness shall be approximately 1.6 mm (1/16 inch). Duct insulation shall be continuous through sleeves and prepared openings except fire wall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder shall cover the collar, neck, and any uninsulated surfaces of diffusers, registers and grills. Vapor retarder materials shall be applied to form a complete unbroken vapor seal over the insulation.

3.3.2.1 Installation on Concealed Duct

a. For rectangular, oval or round ducts, insulation shall be attached by applying Class 2 adhesive around the entire perimeter of the duct in 150 mm wide strips on 300 mm centers.

b. For rectangular and oval ducts, 600 mm (24 inches) and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 450 mm centers and not more than 450 mm from duct corners.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 450 mm centers and not more than 450 mm from duct corners.

d. Insulation shall be impaled on the mechanical fasteners where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor retarder jacket joints overlap 50 mm. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hangers.

e. Self-locking washers shall be installed where mechanical fasteners are used. The pin shall be trimmed back and bent over.

f. Jacket overlaps shall be secured under the overlap with Class 2 adhesive and stapled on 100 mm centers. Staples and seams shall be coated with a brush coat of vapor retarder coating.

g. Breaks in the jacket material shall be covered with patches of the same material as the vapor retarder. The patches shall extend not less than 50 mm beyond the break or penetration in all directions and shall be secured with Class 2 adhesive and staples. Staples and joints shall be sealed with a brush coat of vapor retarder coating.

h. At jacket penetrations such as hangers thermometers and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor retarder coating.

i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish. The coating shall overlap the adjoining insulation and uninsulated surface 50 mm. Pin puncture coatings shall extend 50 mm from the puncture in all directions.

j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

3.3.2.2 Installation on Exposed Duct Work

a. For rectangular ducts, rigid insulation shall be secured to the duct by mechanical fasteners on all four sides of the duct, spaced not more than 300 mm apart and not more than 75 mm from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 300 mm and larger. One row shall be provided for each side of duct less than 300 mm.

b. Duct insulation shall be formed with minimum jacket seams. Each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projections is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over. Vapor retarder jacket shall be continuous across seams, reinforcing, and projections. When height of projections is greater than the insulation thickness, insulation and jacket shall be carried over.

c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and the pin trimmed and bent

over.

d. Joints in the insulation jacket shall be sealed with a 100 mm wide strip of the same material as the vapor retarder jacket. The strip shall be secured with Class 2 adhesive and stapled. Staples and seams shall be sealed with a brush coat of vapor retarder coating.

e. Breaks and ribs or standing seam penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 50 mm beyond the break or penetration and shall be secured with Class 2 adhesive and stapled. Staples and joints shall be sealed with a brush coat of vapor retarder coating.

f. At jacket penetrations such as hangers, thermometers, and damper operating rods, the voids in the insulation shall be filled and the penetrations sealed with a brush coat of vapor retarder coating.

g. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish. The coating shall overlap the adjoining insulation and uninsulated surface 50 mm. Pin puncture coatings shall extend 50 mmfrom the puncture in all directions.

h. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation with minimum density of 12 kg per cubic meter (3/4 pcf) attached by applying Class 2 adhesive around the entire perimeter of the duct in 150 mm wide stripe on 300 mm centers.

3.3.3 Insulation for Warm Air Duct

For warm air ducts above 16 degrees C,ducts and associated equipment shall be insulated to a thickness which is in accordance with Table III. The following shall be insulated:

a. Supply ducts.

b. Return air ducts.

c. Relief air ducts.

d. Flexible runouts (field insulated).

e. Plenums.

f. Fresh air intake ducts.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 12 kg per cubic meter (3/4 pcf); and rigid type where exposed, minimum density 48 kg per cubic meter (3 pcf). Insulation on exposed ducts shall be provided with a white, paintable, factory-applied Type II jacket, or finished with Class 1 adhesive finish. Flexible type insulation shall be used for round ducts, minimum density 12 kg per cubic meter (3/4 pcf) with a factory-applied Type II jacket. Insulation on concealed duct shall be provided with a factory-applied Type II jacket. Class 1 adhesive finish where indicated to be used shall be accomplished by applying two coats of Class 1 adhesive with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 1.6 mm (1/16 inch). Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.3.3.1 Installation on Concealed Duct

a. For rectangular, oval and round ducts, insulation shall be attached by applying Class 2 adhesive around the entire perimeter of the duct in 150 mm wide strips on 300 mm centers.

b. For rectangular and oval ducts 600 mm and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 450 mm centers and not more than 450 mm from duct corner.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 450 mm centers and not more than 450 mm from duct corners.

d. The insulation shall be impaled on the mechanical fasteners where used and shall be pressed thoroughly into the adhesive. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type hangers.

e. Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.

f. Insulation jacket shall overlap not less than 50 mm at joints and the lap shall be secured with Class 2 adhesive under the lap and stapled on 100 mm centers.

3.3.3.2 Installation on Exposed Duct

a. For rectangular ducts, the rigid insulation shall be secured to the duct by the use of mechanical fasteners on all four sides of the duct, spaced not more than 300 mm apart and not more than 75 mm from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 300 mm and larger and a minimum of one row for each side of duct less than 300 mm.

b. Duct insulation with factory-applied jacket shall be formed with minimum jacket seams, and each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projection is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over the projection. Jacket shall be continuous across seams, reinforcing, and projections. Where the height of projections is greater than the insulation thickness, insulation and jacket shall be carried over the projection.

c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and pin excess clipped and bent over.

d. Joints on jacketed insulation shall be sealed with a 100 mm (4 inch) wide strip of the same material as the jacket. The strip shall be secured with Class 2 adhesive and stapled.

e. Breaks and penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 50 mm beyond the break or penetration and shall be secured with Class 2 adhesive and stapled.

f. Insulation terminations and pin punctures shall be sealed and flashed with a Class 1 adhesive. Two coats of Class 1 adhesive coating shall be applied with glass cloth embedded between coats. The total coating shall have a dry film thickness of approximately 1.6 mm (1/16 inch) and shall overlap the adjoining insulation and uninsulated surface 50 mm.

g. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation, minimum density of 12 kg per cubic meter (3/4 pcf) attached by applying Class 2 adhesive around the entire perimeter of the duct in 150 mm

wide stripe on 300 mm center. Joints shall be sealed with a 100 mm (4 inch) wide strip of the same material as the jacket. The strip shall be secured with Class 2 adhesive and stapled.

3.3.4 Ducts Handling Air for Dual Purpose

For air handling ducts for dual purpose below and above 16 degrees C, ducts shall be insulated as specified for cold air duct.

3.3.5 NOT USED

3.3.6 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

3.4 EQUIPMENT INSULATION INSTALLATION

3.4.1 General

Removable insulation sections shall be provided to cover parts of equipment which must be opened periodically for maintenance including vessel covers, fasteners, flanges and accessories. Equipment insulation shall be omitted on the following:

a. Handholes.

b. Boiler manholes.

c. Cleanouts.

d. ASME stamps.

e. Manufacturer's nameplates.

3.4.2 Insulation for Cold Equipment

Cold equipment below 16 degrees C: Insulation shall be furnished on equipment handling media below 16 degrees C including the following:

a. Pumps.

b. Refrigeration equipment parts that are not factory insulated.

c. Drip pans under chilled equipment.

d. Cold and chilled water pumps.

e. Roof drain bodies.

f. Air handling equipment parts that are not factory insulated.

g. Expansion and air separation tanks.

3.4.2.1 Insulation Type

Insulation shall be suitable for the temperature encountered. Thicknesses shall be as follows:

a. Equipment Handling Media Between 2 and 16 degrees C: 50 mm (2 inch) thick cellular glass or 38 mm (1-1/2 inch) thick flexible cellular.

3.4.2.2 Pump Insulation

a. Pumps shall be insulated by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints which do not leave raw ends of insulation exposed. Joints between sides and between sides and bottom shall be joined by adhesive with lap strips for rigid mineral fiber and contact adhesive for flexible cellular insulation. The box shall conform to the requirements of MICA-01 plate No. 49 when using flexible cellular insulation. Joints between top cover and sides shall fit tightly forming a female shiplap joint on the side pieces and a male joint on the top cover, thus making the top cover removable.

b. Exposed insulation corners shall be protected with corner angles.

c. Upon completion of installation of the insulation, including removable sections, two coats of vapor retarder coating shall be applied with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1.6 mm (1/16 inch). A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. Caulking shall be applied to parting line, between equipment and removable section insulation, and at all penetrations.

3.4.2.3 Other Equipment

a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.

b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not more than 300 mm centers except flexible cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.

c. Cellular glass insulation shall be set in a coating of bedding compound, and joints shall be sealed with bedding compound as recommended by the manufacturer. Mineral fiber insulation joints shall be filled with finishing cement.

d. Insulation on heads of heat exchangers shall be removable. Removable section joints shall be fabricated using a male-female shiplap type joint. The entire surface of the removable section shall be finished by applying two coats of vapor retarder coating with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1.6 mm (1/16 inch).

e. Exposed insulation corners shall be protected with corner angles.

f. Insulation on equipment with ribs shall be applied over 150 by 150 mm (6 by 6 inches) by 12 gauge welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 50 by 50 mm (2 by 2 inches) washers or shall be securely banded or wired in place on 300 mmcenters.

3.4.2.4 Vapor Retarder

Upon completion of installation of insulation, penetrations shall be caulked. Two coats of vapor retarder coating shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1.6 mm (1/16 inch). Caulking shall be applied to parting line between equipment and removable section insulation.

3.4.3 Insulation for Hot Equipment

Hot equipment above 16 degrees C: Insulation shall be furnished on equipment handling media above 16 degrees C including the following:

a. Water heaters.

b. Pumps handling media above 54 degrees C.

c. Air separation tanks.

d. Unjacketed boilers or parts of boilers.

e. Boiler flue gas connection from boiler to stack (if inside).

3.4.3.1 Insulation

Insulation shall be suitable for the temperature encountered. Insulation thicknesses shall be as follows:

a. Equipment handling media to 121 degrees C (250 degrees F):50 mm (2 inch) thick rigid mineral fiber, 50 mm (2 inch) thick flexible mineral fiber, 50 mm (2 inch) thick calcium silicate, 38 mm (1.5 inch) cellular glass, 38 mm (1.5 inch) thick phenolic foam, to 93.3 degrees C (200 degrees F) 25 mm (1.0 inch) Flexible Cellular.

3.4.3.2 Insulation of Pumps

Pumps shall be insulated by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints which do not leave raw ends of insulation exposed. Bottom and sides shall be banded to form a rigid housing which does not rest on the pump. Joints between top cover and sides shall fit tightly. The top cover shall have a joint forming a female shiplap joint on the side pieces and a male joint on the top cover, thus making the top cover removable. Two coats of Class I adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. The total dry thickness of the finish shall be 1.6 mm (1/16 inch). Caulking shall be applied to parting line of the removable sections and penetrations.

3.4.3.3 Other Equipment

a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.

b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not greater than 300 mm centers except flexible cellular which shall be adhered. Insulation corners shall be protected under

wires and bands with suitable corner angles.

c. On high vibration equipment, cellular glass insulation shall be set in a coating of bedding compound as recommended by the manufacturer, and joints shall be sealed with bedding compound. Mineral fiber joints shall be filled with finishing cement.

d. Insulation on heads of heat exchangers shall be removable. The removable section joint shall be fabricated using a male-female shiplap type joint. Entire surface of the removable section shall be finished as specified.

e. Exposed insulation corners shall be protected with corner angles.

f. On equipment with ribs such as boiler flue gas connection, draft fans, and fly ash or soot collectors, insulation shall be applied over 150 by 150 mm (6 by 6 inches) by 12 gauge welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 50 by 50 mm (2 by 2 inches) washers or shall be securely banded or wired in place on 300 mm (maximum) centers.

g. On equipment handling media above 316 degrees C (600 degrees F), insulation shall be applied in two or more layers with joints staggered.

h. Upon completion of installation of insulation, penetrations shall be caulked. Two coats of Class I adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1.6 mm (1/16 inch). Caulking shall be applied to parting line between equipment and removable section insulation.

3.4.4 Equipment Handling Dual Temperature Media

Below and above 16 degrees C: Equipment handling dual temperature media shall be insulated as specified for cold equipment.

--END OF SECTION--

SECTION 15250

THERMAL INSULATION FOR MECHANICAL SYSTEMS

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SUBMITTAL REGISTER (ER415-1-10)	CONTRACT NO.
TITLE AND LOCATION Discom Barracks Complex, Phase I Ft. Campbell, Kentucky	CONTRACTOR
	SPEC. SECTION 15250

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.4 SUBMITTALS										
			SD-14 Samples										
			Thermal Insulation Materials; GA.										

SAFETY PAYS

SECTION 15330

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1990) Ferritic Malleable Iron Castings
ASTM A 53	(1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 135	(1993) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1983; R 1990) Carbon Steel Tract Bolts and Nuts
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 795	(1995) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 88	(1995a) Seamless Copper Water Tube
ASTM D 3309	(1994) Polybutylene (PB) Plastic Hot-and Cold-Water Distribution Systems
ASTM F 442	(1994) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.4	(1992) Cast Iron Threaded Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure

	Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B18.2.1	(1981; Supple 1991; R 1992) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1013	(1993) Reduced Pressure Principle Backflow Preventers

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA-10062JU	(1992) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(1992) Hypochlorites
AWWA B301	(1992) Liquid Chlorine
AWWA C104	(1990) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C203	(1991) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825	(1995; Supple I; Supple II; Supple III) Approval Guide

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71	(1990) Cast Iron Swing Check Valves, Flanges and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(1996) Installation of Sprinkler Systems
NFPA 24	(1995) Installation of Private Fire Service Mains and Their Appurtenances
NFPA 1963	(1993) Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES(NICET)

NICET 1014	(1995) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL-01	(1996) Building Materials Directory
UL-04	(1996; Supple) Fire Protection Equipment Directory
UL 668	(1989; Rev Feb 1994) Hose Valves For Fire Protection Service

1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided in areas indicated on the drawings. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation.

1.2.1 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density, over the hydraulically most demanding floor area, as shown on the drawings.. The minimum pipe size for branch lines in gridded systems shall be 32 mm (1-1/4 inch). Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13.

1.2.1.1 Hose Demand

An allowance for exterior hose streams, as shown on the drawings, shall be added to the sprinkler system demand at the fire hydrant shown on the drawings closest to the point where the water service enters the building..

1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supply with a static pressure of 489.8 kPa (71psi), and a flow of 10332.5 L/min (2730 gpm) at a residual pressure of 138.1 kPa (20 psi). The test hydrant for this information is located behind the Aviation Brigade Barracks. Water supply shall be presumed available at the test hydrant. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper

tubing, 140 for new cement-lined ductile-iron piping, and 100 for existing underground piping. Contractor shall be required to take water flow tests prior to completing the final system calculations.

1.2.2 Sprinkler Spacing

Sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler shall not exceed limits specified in NFPA 13 for the occupancies shown on the drawings.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. Submittals related to system configuration, hydraulic calculations, and equipment selection, including manufacturer's catalog data, working drawings, connection drawings, control diagrams and certificates shall be submitted concurrently as a complete package. The package will be reviewed by the U.S. Army Engineer District Fire Protection Engineer. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Load Calculations for Sizing Sway Bracing

For systems that are required to be protected against damage from earthquakes, load calculations shall be provided for sizing of sway bracing.

Sprinkler System Equipment; GA.

Manufacturer's Catalog Data for each separate piece of equipment proposed for use in the system. Data shall indicate the name of the manufacturer of each item of equipment, with data highlighted to indicate model, size, options, etc. proposed for installation. In addition, a complete equipment list which includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; GA.

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Spare Parts; FIO.

Spare parts data shall be included for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

SD-04 Drawings

Sprinkler System Shop Drawings; GA.

Detail drawings conforming to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

b. Floor plans drawn to a scale not less than 1:100 which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

As-Built Drawings; GA.

As-built drawings, no later than 14 working days after completion of the Final Tests. The sprinkler system shop drawings shall be updated to reflect as-built conditions after work is completed and shall be on reproducible full-size mylar film.

SD-06 Instructions

Test Procedures; GA.

Proposed test procedures for piping hydrostatic test, testing of alarms, at least 14 days prior to the start of related testing.

SD-07 Schedules

Preliminary Tests; GA.

A schedule of preliminary tests, at least 14 days prior to the proposed start of the tests.

Final Test; GA.

Upon successful completion of tests specified under PRELIMINARY TESTS, written notification shall be given to the Contracting Officer of the date for the final acceptance test. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

SD-08 Statements

Installer Qualifications; GA.

Qualifications of the sprinkler installer.

Submittal Preparer's Qualifications; GA.

The name and documentation of certification of the individual who will prepare the submittals, prior to the submittal of the drawings and hydraulic calculations.

SD-13 Certificates

Contractor's Material & Test Certificates; GA.

Certificates, as specified in NFPA 13, shall be completed and signed by the Contractor's Representative performing required tests for both underground and aboveground piping.

SD-19 Operation and Maintenance Manuals

Sprinkler System; GA.

Manuals shall be in loose-leaf binder format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. The manuals shall list routine maintenance procedures possible breakdowns, and repairs, and troubleshooting guide. This shall include procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

1.4 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software specifically designed for fire protection system design. Software which uses k-factors for typical branch lines is not acceptable. Calculations shall be taken back to the water supply source unless water supply data is otherwise indicated. Calculations shall substantiate that the design area indicated is the hydraulically most demanding. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.5 SUBMITTAL PREPARER'S QUALIFICATIONS

The sprinkler system submittals, including as-built drawings, shall be prepared by an individual who is either a registered professional engineer or who is certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014.

1.6 INSTALLER QUALIFICATIONS

The installer shall be experienced and regularly engaged in the installation of the type and complexity of system included in this project. A statement prior to submittal of any other data or drawings, that the proposed sprinkler system installer is regularly engaged in the installation of the type and complexity of system included in this project shall be provided. In addition, data identifying the location of at least three systems recently installed by the proposed installer which are

comparable to the system specified shall be submitted. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

1.7 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. Applicable material and installation standards referenced in Appendix A of NFPA 13 and NFPA 24 shall be considered mandatory the same as if such referenced standards were specifically listed in this specification. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. All requirements that exceed the minimum requirements of NFPA 13 shall be incorporated into the design. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.8 DELIVERY AND STORAGE

Equipment placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust or other contaminants.

PART 2 PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.1.2 Requirements for Fire Protection Service

Equipment and materials shall have been tested by Underwriters Laboratories, Inc. and listed in UL-04 or approved by Factory Mutual and listed in FM P7825. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL-04 or FM P7825.

2.1.3 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate permanently affixed to the item of equipment.

2.2 UNDERGROUND PIPING SYSTEMS

2.2.1 Pipe

Piping from a point 150 mm above the floor to a point 1500 mm outside the building wall shall be ductile iron with a rated working pressure of 1034 kPa (150 psi) conforming to AWWA C151, with cement mortar lining conforming to AWWA C104. Piping more than 1500 mm outside the building walls shall comply with Section 02660 WATER LINES.

2.2.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to AWWA C110. Gaskets shall be suitable in design and size for the pipe with

which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111.

2.2.3 Gate Valve and Indicator Posts

Gate valves for underground installation shall be of the inside screw type with counter-clockwise rotation to open. Where indicating type valves are shown or required, indicating valves shall be gate valves with an approved indicator post of a length to permit the top of the post to be located 900 mm above finished grade. Gate valves and indicator posts shall be listed in UL-04 or FM P7825.

2.3 ABOVEGROUND PIPING SYSTEMS

Aboveground piping shall be steel. Plastic piping shall not be used.

2.3.1 Steel Piping System

2.3.1.1 Steel Pipe

Except as modified herein, steel pipe shall be black as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A 795, ASTM A 53, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.3.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings which use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.3.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa (175 psi) service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.3.1.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm (1/16 inch) thick, and full face or self-centering flat ring type. Bolts shall be squarehead conforming to ASME B18.2.1 and nuts shall be hexagon type conforming to ASME B18.2.2.

2.3.2 Copper Tube Systems

2.3.2.1 Copper Tube

Copper tube shall conform to ASTM B 88, Types L and M.

2.3.2.2 Copper Fittings

Cast copper alloy pressure fittings shall conform to ASME B16.18 and wrought copper and bronze pressure fittings shall conform to ASME B16.22.

2.3.3 NOT USED

2.3.4 Pipe Hangers

Hangers shall be listed in UL-04 or FM P7825 and of the type suitable for the application, construction, and pipe type and sized involved.

2.3.5 Valves

2.3.5.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL-01 or FM P7825.

2.3.5.2 Check Valve

Check valve 50 mm (2 inches) and larger shall be listed in UL-01 or FM P7825. Check valves 100 mm (4 inches) and larger shall be of the swing type with flanged cast iron body and flanged inspection plates, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.4 RISER MANIFOLD ASSEMBLY

Assembly shall include a flow switch, pressure gauge, and main drain.

2.5 ELECTRIC ALARM BELL

Electric alarm bell shall be as specified in Section 16721 FIRE DETECTION AND ALARM SYSTEM. The bell will be installed to sound when main riser flow switch is tripped.

2.6 ALARM INITIATING AND SUPERVISORY DEVICES

2.6.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 38 L/min (10 gpm) or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall include two SPDT (Form C) contacts, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

2.6.2 NOT USED

2.6.3 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.7 FIRE DEPARTMENT CONNECTION

Fire department connection shall be projecting type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a polished brass finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 65 mm (2-1/2 inch) diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

2.8 SPRINKLERS

Sprinklers shall be used in accordance with their listed spacing limitations. Temperature classification shall be ordinary, unless otherwise indicated. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13.

2.8.1 Upright Sprinkler

Upright sprinkler shall be brass and shall have a nominal 12.7 mm (1/2 inch) or 13.5 mm (17/32 inch) orifice.

2.8.2 Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, semi-recessed type with nominal 12.7 mm (1/2 inch) or 13.5 mm (17/32 inch) orifice. Pendent sprinklers shall have a polished chrome finish.

2.8.3 Sidewall Sprinkler

Sidewall sprinkler shall have a nominal 12.7 mm (1/2 inch) orifice. Sidewall sprinkler shall have a brass finish. Sidewall sprinkler shall be the quick-response type.

2.9 DISINFECTING MATERIALS

2.9.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.9.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.10 ACCESSORIES

2.10.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.10.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 20 mm and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.10.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.10.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located as required by NFPA 13.

2.10.5 Identification Sign

Valve identification sign shall be minimum 150 mm wide x 50 mm high with enamel baked finish on minimum 1.214 mm (18 gauge) steel or 0.6 mm (0.024 inch) aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

2.11 NOT USED

2.12 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLY

Reduced pressure principle backflow prevention assembly shall comply with ASSE 1013. The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include OS&Y shutoff valves on the inlet and outlet, and four test cocks. Assemblies shall be rated for working pressure of 1034 kPa (150 psi).

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein.

3.2 ABOVEGROUND PIPING INSTALLATION

Piping shall be run straight and bear evenly on hangers and supports.

3.2.1 Protection of Piping Against Earthquake Damage

The system piping shall be protected against damage from earthquakes. Seismic protection of the piping system shall be provided in accordance with NFPA 13 and Appendix A, with the exception that the "Earthquake Zones" map of Appendix A shall not apply to this project. Seismic protection shall include flexible couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required in NFPA 13 for protection of piping against damage from earthquakes. Branch lines shall be equipped with sway braces at the end sprinkler head and at intervals not exceeding 9 m..

3.2.2 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.2.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.2.4 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 25 mm (1 inch) pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 300 mm. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 25 mm below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 100 mm.

3.2.4.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be a minimum of 150 mm from ceiling grid.

3.2.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 750 mm in length shall be individually supported.

3.2.6 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings and fittings shall be from the same manufacturer.

3.2.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 15 mm (1/2 inch).

3.2.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes pass through fire walls, fire partitions, or floors, a fire seal shall be placed between the pipe and sleeve in accordance

with Section 07270 FIRESTOPPING. In penetrations which are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement which will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.2.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.2.10 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 25 mm (1 inch) pipe connected to the remote branch line; a test valve located approximately 2 meters above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

3.2.11 Drains

Main drain piping shall be provided to discharge at the location indicated. Auxiliary drains shall be provided as required by NFPA 13 except that drain valves shall be used where drain plugs are otherwise permitted. Where branch lines terminate at low points and form trapped sections, such branch lines shall be manifolded to a common drain line.

3.2.12 Installation of Fire Department Connection

Connection shall be mounted as shown. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

3.2.13 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.3 UNDERGROUND PIPING INSTALLATION

The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover shall be 900mm. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 150 mm above the finished floor. A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 1500 mm outside the building walls shall meet the requirements of Section 02660 WATER LINES.

3.4 EARTHWORK

Earthwork shall be performed in accordance with applicable provisions of Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

3.5 ELECTRICAL WORK

Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 16721 FIRE DETECTION AND ALARM SYSTEM. Wiring color code shall remain uniform throughout the system.

3.6 STERILIZATION

After system components have been installed and pressure tested, each portion of the completed system shall be sterilized. After pressure tests have been made, the portion to be sterilized shall be thoroughly flushed with water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump, shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall be then flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in properly sterilized containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-10062JU. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The sterilization shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.7 FIELD PAINTING AND FINISHING

Field painting and finishing are specified in Section 09900 PAINTING, GENERAL.

3.8 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.8.1 Underground Piping

3.8.1.1 Flushing

Underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less that the calculated maximum water demand rate of the system.

3.8.1.2 Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 1.89 liters (2 quarts) per hour per 100 gaskets or joints, regardless of pipe diameter.

3.8.2 Aboveground Piping

3.8.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 1400 kPa or 350 kPa in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.8.3 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

3.8.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.9 FINAL ACCEPTANCE TEST

A technician employed by the installing Contractor shall be present for the final tests and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

--END OF SECTION--

SECTION 15330

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

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SUBMITTAL REGISTER (ER415-1-10)	CONTRACT NO.
TITLE AND LOCATION Discom Barracks Complex, Phase I Ft. Campbell, Kentucky	CONTRACTOR / SPEC. SECTION 15330

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-01 Data										
			Sprinkler System Equipment; GA.										
			Hydraulic Calculations; GA.										
			Spare Parts; FIO.										
			SD-04 Drawings										
			Sprinkler System Shop Drawings; GA.										
			As-Built Drawings; GA.										
			SD-06 Instructions										
			Test Procedures; GA.										
			SD-07 Schedules										
			Preliminary Tests; GA.										
			Final Test; GA.										
			SD-08 Statements										
			Installer Qualifications; GA.										
			Submittal Preparer's Qualifications; GA.										
			SD-13 Certificates										
			Contractor's Material & Test Certificates; GA.										
			SD-19 Operation and Maintenance Manuals										
			Sprinkler System; GA.										

SAFETY PAYS

SECTION 15400

PLUMBING, GENERAL PURPOSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 700	(1995) Specifications for Fluorocarbon and Other Refrigerants
ARI 1010	(1994) Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.10.1	(1993; Z21.10.1a; Z21.10.1b; Z21.10.1c) Gas Water Heaters Vol. I Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less
ANSI Z21.10.3	(1993; Z21.10.3a; Z21.10.3b) Gas Water Heaters Vol. III Storage, With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous Water Heaters
ANSI Z21.22	(1986; Z21.22a) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems
ANSI Z21.56	(1994; Z21.56a) Gas-Fired Pool Heaters
ANSI Z124.1	(1995) Plastic Bathtub Units
ANSI Z124.3	(1995) Plastic Lavatories

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1990) Ferritic Malleable Iron Castings
ASTM A 53	(1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 74	(1996) Cast Iron Soil Pipe and Fittings
ASTM A 105	(1996) Forgings, Carbon Steel, for Piping Components

ASTM A 183	(1983; R 1990) Carbon Steel Track Bolts and Nuts
ASTM A 193	(1996) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 515	(1992) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516	(1990) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 518	(1992) Corrosion-Resistant High-Silicon Iron Castings
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 733	(1993) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A 888	(1994) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B 32	(1995b) Solder Metal
ASTM B 42	(1993) Seamless Copper Pipe, Standard Sizes
ASTM B 43	(1994) Seamless Red Brass Pipe, Standard Sizes
ASTM B 75	(1993) Seamless Copper Tube
ASTM B 88	(1996) Seamless Copper Water Tube
ASTM B 111	(1993) Copper and Copper-Alloy Seamless Condenser Tubes and Ferule Stock
ASTM B 117	(1994) Operating Salt Spray (Fog) Testing Apparatus
ASTM B 152	(1994) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 306	(1996) Copper Drainage Tube (DWV)
ASTM B 370	(1992) Copper Sheet and Strip for Building Construction
ASTM B 584	(1996) Copper Alloy Sand Castings for General Applications
ASTM B 641	(1993) Seamless and Welded Copper Distribution Tube (Type D)
ASTM B 813	(1993) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube

ASTM B 828	(1992) Making Capillary Joints by Soldering of Copper and Copper-Alloy Tube and Fittings
ASTM C 564	(1995) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 920	(1994) Elastomeric Joint Sealants
ASTM C 1053	(1990) Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
ASTM D 638	(1996) Tensile Properties of Plastics
ASTM D 1004	(1994a) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D 1248	(1984; R 1989) Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1785	(1994) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2000	(1996) Rubber Products in Automotive Applications
ASTM D 2235	(1993a) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2239	(1994) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D 2241	(1994) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2447	(1993) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
ASTM D 2464	(1994) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1994a) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(1994) Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2485	(1991; R 1996) Evaluating Coatings for High Temperature Service
ASTM D 2564	(1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(1990) Heat-Joining Polyolefin Pipe and Fittings

ASTM D 2661	(1995) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2665	(1995) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2672	(1993; R 1995) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D 2683	(1993) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D 2737	(1993) Polyethylene (PE) Plastic Tubing
ASTM D 2822	(1991) Asphalt Roof Cement
ASTM D 2846	(1995a) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D 2855	(1993) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 2996	(1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3035	(1993) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D 3122	(1993) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings
ASTM D 3138	(1993) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
ASTM D 3139	(1989; R 1995) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3261	(1993) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3308	(1991a) PTFE Resin Skived Tape
ASTM D 3311	(1994) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM D 4060	(1995) Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D 4101	(1995a) Propylene Plastic Injection and Extrusion Materials

ASTM D 4551	(1991) Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane
ASTM E 1	(1995) ASTM Thermometers
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM F 409	(1995) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 437	(1993) Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 438	(1993) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F 439	(1993a) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 441	(1995) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F 442	(1994) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F 477	(1995) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 493	(1993a) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F 628	(1995) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core
ASTM F 891	(1993a) Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core
ASTM F 1290	(1993) Electrofusion Joining Polyolefin Pipe and Fittings

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 34	(1992; Addenda a-j) Number Designation and Safety Classification of Refrigerants
ASHRAE 90.1	(1989; 90.1b; 90.1c; 90.1d; 90.1e; 90.1g; 90.1i) Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.1.2	(1991) Air Gaps in Plumbing Systems
ASME A112.6.1M	(1988) Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.14.1	(1975; R 1990) Backwater Valves
ASME A112.18.1M	(1996) Plumbing Fixture Fittings
ASME A112.19.1M	(1994) Enameled Cast Iron Plumbing Fixtures
ASME A112.19.2M	(1995; Errata) Vitreous China Plumbing Fixtures
ASME A112.19.3M	(1987; R 1996) Stainless Steel Plumbing fixtures (Designed for Residential Use)
ASME A112.19.4M	(1994) Porcelain Enameled Formed Steel Plumbing Fixtures
ASME A112.21.1M	(1991) Floor Drains
ASME A112.21.2M	(1983) Roof Drains
ASME A112.36.2M	(1991) Cleanouts
ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.4	(1992) Gray Iron Threaded Fittings
ASME B16.5	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.12	(1991) Cast Iron Threaded Drainage Fittings
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(1992; Errata Jan 1994) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(1991; Errata) Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500 and 2500, and Flanged

	Fittings, Class 150 and 300
ASME B16.29	(1994) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.34	(1988) Valves - Flanged, Threaded, and Welding End
ASME B16.39	(1986; R 1994) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B31.1	(1995) Power Piping
ASME B31.5	(1992; B31.5a) Refrigeration Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV VIII Div 1	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPV IX	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME CSD-1	(1995) Controls and Safety Devices for Automatically Fired Boilers

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001	(1990) Pipe Applied Atmospheric Type Vacuum Breakers
ASSE 1002	(1964; Rev thru Apr 1986) Water Closet Flush Tank Ball Cocks
ASSE 1003	(1964; Rev thru Oct 1993; Errata Dec 1993) Water Pressure Reducing Valves for Domestic Water Supply Systems
ASSE 1005	(1993) Water Heater Drain Valves - 3/4-Inch Iron Pipe Size
ASSE 1006	(1986) Residential Use (Household) Dishwashers
ASSE 1011	(1995) Hose Connection Vacuum Breakers
ASSE 1012	(1995) Backflow Preventers with Intermediate Atmospheric Vent
ASSE 1013	(1971; Rev thru Oct 1993) Reduced Pressure Principle Backflow Preventers
ASSE 1018	(1977; Rev Jan 1986) Trap Seal Primer Valves Water Supply Fed

ASSE 1037	(1986; Rev thru Mar 1990) Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures/F

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA-01	(1995) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(1992) Hypochlorites
AWWA B301	(1992) Liquid Chlorine
AWWA C105	(1993) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C203	(1991) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(1987) Grooved and Shouldered Joints
AWWA C700	(1995) Cold-Water Meters - Displacement Type, Bronze Main Case
AWWA D100	(1984; D100a) Welded Steel Tanks for Water Storage
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS B2.2	(1991) Brazing Procedure and Performance Qualification

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(1995) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI HSN-85	(1985) Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings

CODE OF FEDERAL REGULATIONS (CFR)

10 CFR 430	Energy Conservation Program for Consumer Products
21 CFR 175	Indirect Food Additives: Adhesives and Components of Coatings

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-238	(Rev B) Seat, Water Closet
CID A-A-240	(Basic) Shower Head, Ball Joint
CID A-A-50012	(Basic) Garbage Disposal Machine, Commercial

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA-02	(1995) Copper Tube Handbook

COUNCIL OF AMERICAN BUILDING OFFICIALS (CABO)

CABO A117.1	(1992; Errata Jun 1993) Accessible and Usable Buildings and Facilities

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCHR)

FCCCHR-01	(1993) Manual of Cross-Connection Control

HYDRAULIC INSTITUTE (HI)

HI 1.1-1.5	(1994) Centrifugal Pumps

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-44	(1996) Steel Pipe Line Flanges
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(1995) Butterfly Valves
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1990) Cast Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-72	(1992) Ball Valves with Flanged or Butt-welding Ends for General Service
MSS SP-73	(1991) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-78	(1987; R 1992) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves

MSS SP-83	(1995) Class 3000 Steel Pipe Unions Socket-Welding and Threaded
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
MSS SP-110	(1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS(NAPHCC)

NAPHCC-01	(1996) National Standard Plumbing Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	(1992) Installation of Oil Burning Equipment
NFPA 54	(1992) National Fuel Gas Code
NFPA 90A	(1993) Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF Std 3	(1982) Dishwashing Machine/Commercial Spray Type
NSF Std 5	(1992) Hot Water Generating Equipment
NSF Std 14	(1965; Rev Nov 1990) Plastics Piping Components and Related Materials

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA-01	(1991) Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI G-101	(1991) Testing and Rating Procedures for Grease Interceptors
PDI WH 201	(1992) Water Hammer Arresters

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J1508	(1993) Hose Clamps

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 5	(1994) White Metal Blast Cleaning

UNDERWRITERS LABORATORIES (UL)

UL 174	(1996) Household Electric Storage Tank Water Heaters
UL 430	(1994; Rev Nov 95) Waste Disposers
UL 732	(1995) Oil-Fired Storage Tank Water Heaters
UL 749	(1995; Rev thru Mar 1996) Household Dishwashers
UL 921	(1992) Commercial Electric Dishwashers

1.2 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening.

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record. Structural members shall be welded in accordance with Section 05055 WELDING, STRUCTURAL.

1.3.2 Cathodic Protection and Pipe Joint Bonding

Cathodic protection and pipe joint bonding systems shall be in accordance with Section 16640 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE).

1.4 ELECTRICAL WORK

Motors, motor controllers and motor efficiencies shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Electrical motor-driven equipment specified herein shall be provided complete with motors. Equipment shall be rated at 60 Hz, single phase, ac unless otherwise indicated. Where a motor controller is not provided in a motor-control center on the electrical drawings, a motor controller shall be as indicated. Motor controllers shall be provided complete with properly sized thermal-overload protection in each ungrounded conductor, auxiliary contact, and other equipment, at the specified capacity, and including an allowable service factor.

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SAFETY PAYS

SD-01 Data

Welding; FIO.

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

Vibration-Absorbing Features; FIO.

Details of vibration-absorbing features, including arrangement, foundation plan, dimensions and specifications.

SD-04 Drawings

Plumbing System; GA.

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operations of each system. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

Electrical Schematics; FIO.

Complete electrical schematic lineless or full line interconnection and connection diagram for each piece of mechanical equipment having more than one automatic or manual electrical control device.

SD-06 Instructions

Plumbing System; FIO.

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe.

SD-09 Reports

Tests, Flushing and Sterilization; FIO.

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Backflow Prevention Assembly Tests; FIO.

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor shall have the manufacturer's representative test the device, to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests.

SD-13 Certificates

Materials and Equipment; FIO.

Where materials or equipment are specified to comply with requirements of AGA, or ASME, proof of such compliance. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

Bolts; FIO.

Written certification by the bolt manufacturer that the bolts furnished comply with the specified requirements. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

SD-19 Operation and Maintenance Manuals

Plumbing System; FIO.

Six copies of the operation manual outlining the step-by-step procedures required for system startup, operation and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs. The manual shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

1.6 REGULATORY REQUIREMENTS

1.6.1 Plumbing

Plumbing work shall be in accordance with NAPHCC-01.

1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.8 VIDEO INSPECTION AND RECORDING EQUIPMENT

The Contractor shall furnish a video inspection and recording system for use on this project. The system shall consist of a video system manager combining a high resolution monitor with a commercial grade VCR, a cable reel with a rust-proof drum attached, a minimum 200 feet of cable, a cable mounted camera head, an in-line transmitter mounted to the camera head, and a hand held pointer receiver. The camera shall be capable of operating in piping sizes 2-inch through 12-inch. The equipment shall be a RIDGID/Kollmann SeeSnake system, or equal. The equipment shall be on site not later than 120 calendar days after Notice to Proceed. The equipment, for use by the Contractor and the Government during construction, shall become the property of the Government upon completion of the project.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF Std 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. Hubless cast-iron soil pipe shall not be installed under concrete floor slabs or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

Grooved pipe shall not be used under ground. Joints and gasket materials shall conform to the following:

a. Coupling for Cast-Iron Pipe: ASTM A 74, AWWA C606.

b. Coupling for Steel Pipe: AWWA C606.

c. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1.6 mm (1/16 inch) thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.

d. Neoprene Gaskets for Hub and Cast-Iron Pipe and Fittings: CISPI HSN-85.

e. Brazing Material: Brazing material shall conform to AWS A5.8, BCuP-5.

f. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides. Silver brazing materials shall be in accordance with AWS A5.8.

g. Solder Material: Solder metal shall conform to ASTM B 32 95-5 tin-antimony.

h. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.

i. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe, ASTM D 3308.

j. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings: ASTM C 564.

k. Flexible Elastomeric Seals: ASTM D 3139, ASTM D 3212 or ASTM F 477.

l. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D 3138.

m. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D 2235.

n. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.

o. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.

p. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc. shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105. Blind flange material shall conform to ASTM A 516 cold service and ASTM A 515 for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Water Hammer Arrester: PDI WH 201.

b. Copper, Sheet and Strip for Building Construction: ASTM B 370.

c. Asphalt Roof Cement: ASTM D 2822.

d. Hose Clamps: SAE J1508.

e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.

f. Metallic Cleanouts: ASME A112.36.2M.

g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.

i. Hypochlorites: AWWA B300.

j. Liquid Chlorine: AWWA B301.

k. Polyethylene Encasement for Ductile-Iron Piping: AWWA C105.

l. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.1.

m. Thermometers: ASTM E 1.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 65 mm (2-1/2 inches) and smaller shall be

bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 80 mm (3 inches) and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Valves shall conform to the following standards:

Description	Standard
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Flared Ends	MSS SP-110
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Vacuum Relief Valves	ASSE 1001
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASSE 1005
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

2.3.1 NOT USED

2.3.2 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 20 mm (3/4 inch) male inlet threads, hexagon shoulder, and 20 mm (3/4 inch) hose connection. Faucet handle shall be securely attached to stem.

2.3.3 Wall Hydrants

Wall hydrants with vacuum-breaker backflow preventer shall have a nickle-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through the wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removable through the face of the hydrant. The hydrant shall have 20 mm (3/4 inch) exposed hose thread on spout and 20 mm (3/4 inch) male pipe thread on inlet.

2.3.4 NOT USED

2.3.5 NOT USED

2.3.6 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22. Relief valves for systems where the maximum rate of heat input is less than 59 kW (200,000 Btuh) shall have 20 mm (3/4 inch) minimum inlets, and 20 mm (3/4 inch) outlets. Relief valves for systems where the maximum rate of heat input is greater than 59 kW (200,000 Btuh)shall have 25 mm (1 inch) minimum inlets, and 25 mm (1 inch) outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with NAPHCC-01. Fixtures for use by the physically handicapped shall be in accordance with CABO A117.1. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 82 degrees C (180 degrees F) water temperature. Plumbing fixtures shall be as indicated in paragraph PLUMBING FIXTURE SCHEDULE.

2.4.1 Lavatories

Enameled cast-iron lavatories shall be provided.

2.4.2 NOT USED

2.5 BACKFLOW PREVENTERS

SAFETY PAYS

Backflow preventers shall be approves and listed by the Foundation For Cross-Connection Control & Hydraulic Research. Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCCHR-01. Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Hose connection vacuum breakers shall conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers shall conform to ASSE 1001. Air gaps in plumbing systems shall conform to ASME A112.1.2.

2.6 DRAINS

2.6.1 Floor and Shower Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded or caulked connection. In lieu of a caulked joint between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C 564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.21.1M.

2.6.1.1 Metallic Shower Pan Drains

Where metallic shower pan membrane is installed, polyethylene drain with corrosion-resistant screws securing the clamping device shall be provided. Polyethylene drains shall have fittings to adapt drain to waste piping. Polyethylene for floor drains shall conform to ASTM D 1248. Drains shall have separate cast-iron "P" trap, circular body, seepage pan, and strainer, unless otherwise indicated.

2.6.1.2 Drains

Drains installed in connection with waterproofed floors or shower pans shall be equipped with bolted-type device to securely clamp flashing.

2.6.2 Area Drains

Area drains shall be plain pattern with polished stainless steel perforated or slotted grate and bottom outlet. The drain shall be circular or square with a 300 mm (12 inch) nominal overall width or diameter and 250 mm (10 inch) nominal overall depth. Drains shall be cast iron with manufacturer's standard coating. Grate shall be easily lifted out for cleaning. Outlet shall be suitable for inside caulked connection to drain pipe. Drains shall conform to ASME A112.21.1M.

2.6.3 NOT USED.

2.6.4 NOT USED

2.6.5 NOT USED

2.6.6 Sight Drains

Sight drains shall consist of body, integral seepage pan, and adjustable strainer with perforated or slotted grate and funnel extension. The strainer shall have a threaded collar to permit adjustment to floor thickness. Drains shall be of double drainage pattern suitable for embedding in the floor construction. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or membrane shall be provided for other than concrete construction. Drains shall have a galvanized heavy cast-iron body and seepage pan and chromium-plated bronze, nickel-bronze, or nickel-brass strainer and funnel combination. Drains shall be provided with threaded or caulked connection and with a separate cast-iron "P" trap, unless otherwise indicated. Drains shall be circular, unless otherwise indicated. The funnel shall be securely mounted over an opening in the center of the strainer. Minimum dimensions shall be as follows:

Area of strainer and collar	0.023 square meters (36 square inches)
Height of funnel	95 mm (3-3/4 inches)
Diameter of lower portion of funnel	50 mm (2 inches)
Diameter of upper portion of funnel	100 mm (4 inches)

2.6.7 NOT USED

2.7 SHOWER PAN

Shower pan may be copper, or nonmetallic material.

2.7.1 Sheet Copper

Sheet copper shall be 4.9 kg per square meter (16 ounce) weight.

2.7.2 Plasticized Polyvinyl Chloride Shower Pan Material

Material shall be sheet form. The material shall be 1.016 mm (0.040 inch) minimum thickness of plasticized polyvinyl chloride or chlorinated polyethylene and shall be in accordance with ASTM D 4551.

2.7.3 Nonplasticized Polyvinyl Chloride (PVC) Shower Pan Material

Material shall consist of a plastic waterproofing membrane in sheet form. The material shall be 1.016 mm (0.040 inch) minimum thickness of nonplasticized PVC and shall have the following minimum properties:

a. ASTM D 638:

Ultimate Tensile Strength:	1.79 MPa (2600 psi)
Ultimate Elongation:	398 percent
100 Percent Modulus:	3.07 MPa (445 psi)

b. ASTM D 1004:

Tear Strength:	53 kilonewtons per meter (300 pounds per inch)

c. ASTM E 96:

Permeance: 0.46 ng per Pa per second per square meter (0.008 perms)

d. Other Properties:

Specific Gravity: 1.29
PVC Solvent: Weldable
Cold Crack: minus 47 degrees C (-53 degrees F)

Dimensional stability, 100 degrees C (212 degrees F) minus 2.5 percent
Hardness, Shore A: 89

2.8 TRAPS

Unless otherwise specified, traps shall be plastic per ASTM F 409 or copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.813 mm (0.032 inch) thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 50 mm (2 inches). The interior diameter shall be not more than 3.2 mm (1/8 inch) over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.9 GREASE INTERCEPTOR

Grease interceptor of the size indicated shall be of reinforced concrete, or precast concrete construction with removable three-section, 9.5 mm (3/8 inch) checker-plate cover, and shall be installed outside the building. Steel grease interceptor shall be installed in a concrete pit and shall be epoxy-coated to resist corrosion as recommended by the manufacturer. Interceptors shall be tested and rated in accordance with PDI G-101. Concrete shall have 21 MPa minimum compressive strength at 28 days.

2.10 WATER HEATER

Water heater types and capacities shall be as indicated. Each primary water heater shall have controls adjustable from 32 to 49 degrees C (90 to 120 degrees F). Each gas-fired water heater and booster water heater shall have controls adjustable from 49 to 82 degrees C (120 to 180 degrees F). Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and stand by heat losses shall conform to TABLE III for each type of water heater specified. The only exception is that the storage capacity need not meet the standard loss requirement if the tank surface area is not insulated to R-12.5 and if a standing light is not used.

2.10.1 Automatic Storage Type

Heaters shall be complete with control system, temperature gauge, and pressure gauge,and shall have ASME rated

combination pressure and temperature relief valve.

2.10.2 NOT USED

2.10.3 Gas-Fired Type

Gas-fired water heaters shall conform to ANSI Z21.10.1 when input is 22 kW (75,000 Btu per hour) or less or ANSI Z21.10.3 for heaters with input greater than 22 kW (75,000 Btu per hour).

2.10.4 through 2.10.7 NOT USED

2.11 EXPANSION TANKS

Each waqter heater shall be equipped with a diaphragm-type expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting the pressure increase at all components in the system to the maximum allowable pressure at those components. The sizes shall be as indicated. The expansion tank shall be welded steel, constructed, tested, and stamped in accordance with ASME BPV VIII Div 1 for a working pressure of 850 kPa (125 psi) and precharged to the minimum operating pressure. The tank's air chamber shall be fitted with an air charging valve and pressure gauge. The tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations. The tank shall have lifting rings and a drain connection. All components shall be suitable for a maximum operating temperature of 120 degrees C (250 degrees F).

2.12 PUMPS

2.12.1 Sump Pumps

Sump pumps shall be of capacities indicated. The pumps shall be of the automatic, electric motor-driven, submerged type, complete with necessary control equipment and with a split or solid cast-iron or steel cover plate. The pumps shall be direct-connected by an approved flexible coupling to a vertical electric motor having a continuous oiling device or packed bearings sealed against dirt and moisture. Motors shall be totally enclosed, fan-cooled of sizes as indicated and shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 4 enclosed, across-the-line, magnetic controller. Each pump shall be fitted with a high-grade thrust bearing mounted above the floor. Each shaft shall have an alignment bearing at each end, and the suction inlet shall be between 75 and 150 mm above the sump bottom. The suction side of each pump shall have a strainer of ample capacity. A float switch assembly, with the switch completely enclosed in a NEMA 250, Type 4 enclosure, shall start and stop each motor at predetermined water levels. Duplex pumps shall be equipped with an automatic alternator to change the lead operation from one pump to the other, and for starting the second pump if the flow exceeds the capacity of the first pump. The discharge line from each pump shall be provided with a union or flange, a nonclog swing check valve, and a stop valve in an accessible location near the pump.

2.12.2 Circulating Pumps

Domestic hot water circulating pumps shall be electrically driven, single-stage, centrifugal, with mechanical seals, suitable for the intended service. Pump capacities, efficiencies, motor sizes, speeds, and impeller types shall be as shown. Pump and motor shall be integrally mounted on a cast-iron or steel subbase,close-coupled with an overhung impeller, or supported by the piping on which it is installed. The shaft shall be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze. Motor shall be totally enclosed, fan-cooled and shall have sufficient wattage (horsepower)for the service required. Pump shall conform to HI 1.1-1.5. Each pump motor shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in cover. Pump motors smaller than 746 W (Fractional horsepower pump motors) shall have integral

thermal overload protection in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Guards shall shield exposed moving parts.

2.12.3 NOT USED

2.12.4 Flexible Connectors

Flexible connectors shall be provided at the suction and discharge of each pump that is 1 hp or larger. Connectors shall be constructed of neoprene, rubber, or braided bronze, with Class 150 standard flanges. Flexible connectors shall be line size and suitable for the pressure and temperature of the intended service.

2.13 NOT USED

2.14 NOT USED

2.15 DOMESTIC WATER SERVICE METER

Cold water meter shall be of the positive displacement type conforming to AWWA C700. Meter register may be round or straight reading type, indicating U.S. gallons. Meter shall be provided with a pulse generator, remote readout register and all necessary wiring and accessories.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Hubless cast-iron pipe shall not be installed under concrete floor slabs. Piping located in air plenums shall conform to NFPA 90A requirements. Unprotected plastic pipe shall not be installed in air plenum. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA-01. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 1.5 m outside the building, unless otherwise indicated. A gate valve or ball valve and drain shall be installed on the water service line inside the building approximately 150 mm above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 300 mm below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 15 mm between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific excepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 100 mm (4 inches) and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 20 mm (3/4 inch) hose bibb with renewable seat and gate ball valve ahead of hose bibb. At other low points, 20 mm (3/4 inch) brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 15 m in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.

3.1.1.7 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to PDI WH 201. Vertical capped pipe columns will not be permitted.

SAFETY PAYS

3.1.2 NOT USED

3.1.3 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.3.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.3.2 NOT USED

3.1.3.3 Union and Flanged

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 65 mm (2-1/2 inches) and smaller; flanges shall be used on pipe sizes 80 mm (3 inches) and larger.

3.1.3.4 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.3.5 Copper Tube and Pipe

The tube or fittings shall not be annealed when making connections. Connections shall be made with a multiflame torch.

a. Brazed. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA-02 with flux and are acceptable for line sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.

b. Soldered. Soldered joints shall be made with flux and are only acceptable for lines 50 mm (2 inches) and smaller. Soldered joints shall conform to ASME B31.5 and CDA-02.

c. Copper Tube Extracted Joint. An extracted mechanical joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. Branch tube shall be notched for proper penetration into fitting to ensure a free flow joint. Extracted joints shall be brazed in accordance with NAPHCC-01 using B-Cup series filler metal in accordance with MSS SP-73. Soldered extracted joints will not be permitted.

3.1.3.6 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

3.1.4 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper pipe shall be made with dielectric unions or flange waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.5 Corrosion Protection for Buried Pipe and Fittings

3.1.5.1 Cast Iron and Ductile Iron

Pressure pipe shall have protective coating, a cathodic protection system, and joint bonding. Pipe, fittings, and joints shall have a protective coating. The protective coating shall be completely encasing polyethylene tube or sheet in accordance with AWWA C105. Joints and fittings shall be cleaned, coated with primer, and wrapped with tape. The pipe shall be cleaned, coated, and wrapped prior to pipe tightness testing. Joints and fittings shall be cleaned, coated, and wrapped after pipe tightness testing. Tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer shall be as recommended by the tape manufacturer.

3.1.5.2 Steel

Steel pipe, joints, and fittings shall be cleaned, coated with primer, and wrapped with tape. Pipe shall be cleaned, coated, and wrapped prior to pipe tightness testing. Joints and fittings shall be cleaned, coated, and wrapped after pipe tightness testing. Tape shall conform to AWWA C203and shall be applied with a 50 percent overlap. Primer shall be as recommended by the tape manufacturer.

3.1.6 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.6.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for cast-iron soil pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve with corrosion-protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 100 mm above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 6 mm (1/4 inch) clearance between bare pipe and inside of sleeve or between jacket over insulation and sleeves. Sleeves in bearing walls shall be steel pipe or cast-iron pipe. Sleeves for membrane waterproof floors shall be steel pipe, cast-iron pipe, or plastic pipe. Membrane clamping devices shall be provided on pipe sleeves for waterproof floors. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. Plastic sleeves shall not be used in nonbearing fire walls, roofs, or floor/ceilings. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C 920 and

with a primer, backstop material and surface preparation as specified in Section 07920 JOINT SEALING. Pipes passing through sleeves in concrete floors over crawl spaces shall be sealed as specified above. The annular space between pipe and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 15 mm from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and masonry wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant.

3.1.6.2 Flashing Requirements

For STANDING SEAM Metal Roof: Pipes passing through roof shall be installed through a preformed neoprene sleeve with hose clamp. The boot shall extend not less than 200 mm from the pipe. The neoprene sleeve shall extend up the pipe a minimum of 250 mm.

For MODIFIED BITUMEN Roof: Pipes passing through roof or floor waterproofing membrane shall be installed through a 4.9 kg per square meter (16 ounce)copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 200 mm from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 250 mm. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 200 mm from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 250 mm (10 inches)in diameter, passing through roof or floor waterproofing membrane may be installed through a sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.6.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 40 mm to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 40 mm; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 200 mmfrom the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 40 mm to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.6.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

a. A standard roof coupling for threaded pipe up to 150 mm (6 inches) in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

3.1.6.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 6 to 13 mm wide by 6 to 10 mm deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07920 JOINT SEALING.

3.1.7 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07270 FIRESTOPPING.

3.1.8 Supports

3.1.8.1 General

Hangers used to support piping 50 mm (2 inches) and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.1.8.2 Pipe Supports and Structural Bracing, Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads as specified Section 13080. Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided. Material used for supports shall be as specified in Section 05120 STRUCTURAL STEEL.

3.1.8.3 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Type 39 saddles shall be used on insulated pipe 100 mm (4 inches) and larger when the temperature of the medium is 15 degrees C or higher. Type 39 saddles shall be welded to the pipe.

h. Type 40 shields shall:

(1) Be used on insulated pipe less than 100 mm (4 inches).

(2) Be used on insulated pipe 100 mm (4 inches) and larger when the temperature of the medium is 15 degrees C or less.

(3) Have a high density insert for pipe 50 mm (2 inches) and larger and for smaller pipe sizes when the insulation is suspected of being visibly compressed, or distorted at or near the shield/insulation interface. High density inserts shall have a density of 128 kg per cubic meter (8 pcf) or greater.

i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 300 mm from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 49 degrees C for PVC and 82 degrees C for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.

j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 4.5 m nor more than 2 m from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

k. Type 40 shields used on insulated pipe shall have high density inserts with a density of 128 kg per cubic meter (8 pcf) or greater.

l. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:

(1) On pipe 100 mm (4 inches) and larger when the temperature of the medium is 15 degrees C or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) On pipe less than 100 mm (4 inches) a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

(3) On pipe 100 mm (4 inches) and larger carrying medium less that 15 degrees C a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

m. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.

n. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 100 mm or by an amount adequate for the insulation, whichever is greater.

o. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

3.1.9 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.10 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 100 mm (4 inches) will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 100 mm (4 inches). Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 450 mmof crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 150 mm above the top of the tank or water heater.

3.2.2 Installation of Gas- Fired Water Heater

Installation shall conform to NFPA 54 for gas fired. Storage water heaters that are not equipped with integral heat traps and having vertical pipe risers shall be installed with heat traps directly on both the inlet and outlet. Circulating systems need not have heat traps installed. An acceptable heat trap may be a piping arrangement such as elbows connected so that the inlet and outlet piping make vertically upward runs of not less than 600 mm just before turning downward or directly horizontal into the water heater's inlet and outlet fittings. Commercially available heat traps, specifically designed by the manufacturer for the purpose of effectively restricting the natural tendency of hot water to rise through vertical inlet and outlet piping during standby periods may also be approved.

3.2.3 NOT USED

3.2.4 Heat Traps

Piping to and from each water heater and hot water storage tank shall be routed horizontally and downward a minimum of 600 mm before turning in an upward direction.

3.2.5 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be installed 1 m above the floor. Bumpers for water closet seats shall be installed on the.

3.3.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 775 mm above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim 1020 mm above floor. Wall-hung service sinks shall be mounted with rim 700 mm above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with CABO A117.1.

3.3.4 Shower Bath Outfits

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

3.3.5 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use,

shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.5.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

3.3.5.2 Support for Cellular-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the cellular wall using through bolts and a back-up plate.

3.3.5.3 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.5.4 NOT USED

3.3.5.5 Wall-Mounted Water Closet Gaskets

Where wall-mounted water closets are provided, reinforced wax, treated felt, or neoprene gaskets shall be provided. The type of gasket furnished shall be as recommended by the chair-carrier manufacturer.

3.3.6 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with NAPHCC-01 at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.7 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METAL.

3.3.8 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 50 mm above the flood rim of the funnel to provide an acceptable air gap.

3.3.9 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D 3311.

3.3.10 Shower Pans

Before installing shower pan, subfloor shall be free of projections such as nail heads or rough edges of aggregate. Drain shall be a bolt-down, clamping-ring type with weepholes, installed so the lip of the subdrain is flush with subfloor.

3.3.10.1 General

The floor of each individual shower, the shower-area portion of combination shower and drying room, and the entire shower and drying room where the two are not separated by curb or partition, shall be made watertight with a shower pan fabricated in place. The shower pan material shall be cut to size and shape of the area indicated, in one piece to the maximum extent practicable, allowing a minimum of 150 mm for turnup on walls or partitions, and shall be folded over the curb with an approximate return of 1/4 of curb height. The upstands shall be placed behind any wall or partition finish. Subflooring shall be smooth and clean, with nailheads driven flush with surface, and shall be sloped to drain. Shower pans shall be clamped to drains with the drain clamping ring.

3.3.10.2 Metal Shower Pans

When a shower pan of required size cannot be furnished in one piece, metal pieces shall be joined with a flatlock seam and soldered or burned. The corners shall be folded, not cut, and the corner seam shall be soldered or burned. Pans, including upstands, shall be coated on all surfaces with one brush coat of asphalt. Asphalt shall be applied evenly at not less than 1 liter per square meter. A layer of felt covered with building paper shall be placed between shower pans and wood floors. The joining surfaces of metal pan and drain shall be given a brush coat of asphalt after the pan is connected to the drain.

3.3.10.3 Nonplasticized Chlorinated Polyethylene Shower Pans

Corners of nonplasticized chlorinated polyethylene shower pans shall be folded against the upstand by making a pig-ear fold. Hot-air gun or heat lamp shall be used in making corner folds. Each pig-ear corner fold shall be nailed or stapled 15 mm from the upper edge to hold it in place. Nails shall be galvanized large-head roofing nails. On metal framing or studs, approved duct tape shall be used to secure pig-ear fold and membrane. Where no backing is provided between the studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding 15 mm from upper edge. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it will be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Surfaces to be solvent-welded shall be clean. Surfaces to be joined with xylene shall be initially sprayed and vigorously cleaned with a cotton cloth, followed by final coating of xylene and the joining of the surfaces by roller or equivalent means. If ambient or membrane temperatures are below 4 degrees C the membrane and the joint shall be heated prior to application of xylene. Heat may be applied with hot-air gun or heat lamp, taking precautions not to scorch the membrane. Adequate ventilation and wearing of gloves are required when working with xylene. Membrane shall be pressed into position on the drain body, and shall be cut and fit to match so that membrane can be properly clamped and an effective gasket-type seal provided. On wood subflooring, two layers of 0.73 kg per square meter (15 pound) dry felt shall be installed prior to installation of shower pan to ensure a smooth surface for installation.

3.3.10.4 Nonplasticized Polyvinyl Chloride (PVC) Shower Pans

Nonplasticized PVC shall be turned up behind walls or wall surfaces a distance of not less than 150 mm in room areas and 75 mm above curb level in curbed spaces with sufficient material to fold over and fasten to outside face of curb. Corners shall be pig-ear type and folded between pan and studs. Only top 25 mm of upstand shall be nailed to hold in place. Nails shall be galvanized large-head roofing type. Approved duct tape shall be used on metal framing or studs to secure pig-ear fold and membrane. Where no backing is provided between studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding at top inch of upstand. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it is to be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Trim for drain shall be exactly the size of drain opening. Bolt holes shall be pierced to accommodate bolts with a tight fit. Adhesive shall be used between pan and subdrain. Clamping ring shall be bolted firmly. A small amount of gravel or porous materials shall be placed at weepholes so that holes remain clear when setting bed is poured. Membrane shall be solvent welded with PVC solvent cement. Surfaces to be solvent welded shall be clean (free of grease and grime). Sheets shall be laid on a flat surface with an overlap of about 50 mm. Top edge shall be folded back and surface primed with a PVC primer. PVC cement shall be applied and surfaces immediately placed together, while still wet. Joint shall be lightly rolled with a paint roller, then as the joint sets shall be rolled firmly but not so hard as to distort the material. In long lengths, about 600 or 900 mm at a time shall be welded. On wood subflooring, two layers of 0.73 kg per square meter (15 pound) felt shall be installed prior to installation of shower pan to ensure a smooth surface installation.

3.4 NOT USED

3.5 NOT USED

3.6 IDENTIFICATION SYSTEMS

3.6.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 35 mm (1-3/8 inch) minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.6.2 Color Coding

Color coding for piping identification shall be as specified in Section 09900 PAINTING, GENERAL.

3.6.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 12 mm (3/8 inch) in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 1 m width, 750 mm height, and 12 mm (1/2 inch) thickness. The board shall be made of wood fiberboard and framed under glass or 1.6 mm (1/16 inch) transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 20 mm (3/4 inch) in diameter and the related lettering in 15 mm (1/2 inch) high capital letters. The color

code board shall be mounted and located in the mechanical or equipment room. The color code system shall be as specified in Section 09900, PAINTING, GENERAL.

3.7 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.8 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09900PAINTING, GENERAL.

3.9 TESTS FLUSHING AND STERILIZATION

3.9.1 Plumbing System

The plumbing system shall be tested in accordance with NAPHCC-01.

3.9.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies. Gauges shall be tested annually for accuracy in accordance with the University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14). Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	Test Pressure Readings
Serial Number and Test Data of Gauges	

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.9.1.2 Shower Pans

After installation of the pan and finished floor, the drain shall be temporarily plugged below the weep holes. The floor

area shall be flooded with water to a minimum depth of 25 mm for a period of 24 hours. Any drop in the water level during test, except for evaporation, will be reason for rejection, repair, and retest.

3.9.1.3 Sanitary Sewer Lines

After all fixtures are installed and operating and prior to beneficial occupancy, the building underfloor sanitary sewer lines shall be inspected for blockage and/or breaks using video inspection and recording equipment. All main lines shall be tested. Video tape recordings of each of these tests shall be made and copies furnished to the Contracting Officer's Representative.

3.9.2 NOT USED

3.9.3 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be permitted.

3.9.4 System Flushing

After tests are completed, potable water piping shall be flushed. In general, sufficient water shall be used to produce a minimum water velocity of 0.762 meters per second (2.5 feet per second) through piping being flushed. Flushing shall be continued until discharge water shows no discoloration. System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced in line. After flushing and cleaning, systems shall be prepared for service by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the work is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation.

3.9.5 Operational Test

Upon completion of and prior to acceptance of the installation, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

a. Time, date, and duration of test.

b. Water pressures at the most remote and the highest fixtures.

c. Operation of each fixture and fixture trim.

d. Operation of each valve, hydrant, and faucet.

e. Temperature of each domestic hot-water supply.

f. Operation of each floor and roof drain by flooding with water.

g. Operation of each vacuum breaker and backflow preventer.

3.9.6 Disinfection

After pressure tests have been made, the entire domestic hot- and cold-water distribution system shall be sterilized. System shall be thoroughly flushed with water of sufficient velocity until all entrained dirt and other foreign material have been removed, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being sterilized shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6 hour period, no less than 50 ppm chlorine residual shall remain in the tank. The system including the tanks shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. From several points in the system the Contracting Officer will take samples of water in properly sterilized containers for bacterial examination. The samples of water shall be tested by Fort Campbell Water Plant personnel for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-01. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. The sterilizing shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.10 PLUMBING FIXTURE SCHEDULE

P-1 WATER CLOSET:

Siphon-jet, elongated bowl, top supply spud, ASME A112.19.2M, wall mounted.

Seat - CID A-A-238, Type A, white plastic, elongated, open front.

Flushometer Valve - ASSE 1037, large diaphragm type with non-hold-open feature, backcheck angle control stop, and vacuum breaker. Minimum upper chamber inside diameter of not less than 66.7 mm (2-5/8 inches) at the point where the diaphragm is sealed between the upper and lower chambers. The maximum water use shall be 6 liters per flush.

P-1A WATER CLOSET HANDICAPPED:

Top rim of bowl shall be 457 mm (18 inches) above the floor; other features are the same as P-1.

P-1B WATER CLOSET:

Siphon-jet, elongated bowl, top supply spud, ASME A112.19.2M, floor mounted. Floor flange shall be copper alloy, cast iron, or plastic.

Gasket shall be wax type.

Seat - CID A-A-238, Type A, white plastic, elongated, open front.

Flush Tank - An adequate quantity of water shall be provided to flush and clean the fixture served. The water supply to

flush tanks equipped for manual flushing shall be controlled by a float valve or other automatic device designed to refill the tank after each discharge, and to completely shut off the water flow to the tank when the tank is filled to operational capacity. Water closets having their flush valve seat located below the flood level rim of the closet bowl shall have a ballcock installed within a sheath or in a separate and isolated compartment of the tank, both to have visible discharge onto the floor in case of failure. Provision shall be made to automatically supply water to the fixture so as to refill the trap seal after each flushing. The water supply to flush tanks equipped for automatic flushing shall be controlled by a suitable timing device. Ballcocks shall meet ASSE 1002.

P-2 URINAL:

Wall hanging, with integral trap and extended shields, ASME A112.19.2Msiphon jet. Top supply connection, back outlet.

Flushometer Valve - Similar to Flushometer Valve for P-1. The maximum water use shall be 3.8 liters per flush.

P-2A URINAL HANDICAPPED:

Top of lip shall be 432 mm above the floor; other features are the same as P-2.

P-3 LAVATORY:

Manufacturer's standard sink depth, enameled cast iron ASME A112.19.1M, straight back, ledge back, shelf back, or countertop, oval.

Faucet - Faucets shall be center set type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. Flow shall be limited to 0.16 liters per second at a flowing pressure of 549 kPa.

Handles - Index turn type. Cast, formed, or drop forged copper alloy.

Drain - Strainer shall be copper alloy or stainless steel.

P-3A WHEELCHAIR LAVATORY:

Same as P-3 except faucet shall have lever handles.

P-4 SHOWER:

Shower heads, CID A-A-240 other than emergency showers, shall include a non-removable, tamperproof device to limit water flow to 0.16 liters per second (2.5 gpm) when tested in accordance with ASME A112.18.1M.

Wall Mounted: Shower head shall be nonadjustable spray, stainless steel or chromium plated brass with ball joint. Handles shall be chrome-plated die cast zinc alloy. Control valves shall be copper alloy and have metal integral parts of copper alloy, nickel alloy, or stainless steel. Valves shall be thermostatic mixing type. Shower head shall be vandalproof with integral back.

P-5 WATER COOLER DRINKING FOUNTAINS:

Water cooler drinking fountains shall: be self contained, conform to ARI 1010, use one of the fluorocarbon gases

conforming to ARI 700 and ASHRAE 34 which has an Ozone Depletion Potential of less than or equal to 0.05, have a capacity to deliver 30.2 liters per hour (8 gph) of water at 10 degrees C (50 degrees F) with an inlet water temperature of 27 degrees C (80 degrees F) while residing in a room environment of 32 degrees C (90 degrees F),and have self-closing valves. Self-closing valves shall have automatic stream regulators, have a flow control capability, have a push button actuation or have a cross-shaped index metal turn handle without a hood. Exposed surfaces of stainless steel shall have No. 4 general polish finish. Spouts shall provide a flow of water at least 100 mm (4 inches) high so as to allow the insertion of a cup or glass under the flow of water.

Surface Wall-Mounted - Surface wall-mounted units shall be 336.6 mm (13-1/4 inches) wide, 330.2 mm (13 inches) deep, and have a back height of 152.4 to 203.2 mm (6 to 8 inches). The bowl shall be made of corrosion resisting steel. The unit shall have concealed fasteners and be for interior installation.

P-5A WATER COOLER DRINKING FOUNTAIN (HANDICAPPED):

Requirements for the handicapped water cooler drinking fountain are the same as those of the water cooler drinking fountain (P-5), except as noted below.

Handicapped - Handicapped units shall be surface wall-mounted. The dimensions shall be 381.0 mm (15 inches) wide, 508.0 mm (20 inches) deep. The unit shall clear the floor or ground by at least 200 mm (8 inches). A clear knee space shall exist between the bottom of the bowl and the floor or ground of at least 685 mm (27 inches) and between the front edge of the bowl and the body of the unit of at least 200 mm (8 inches). A 200 mm (8 inch) wide clear space shall exist on both sides of the unit. The spout height shall be no more than 1 m (36 inches) above the floor or ground to the outlet. The spout shall be at the front of the unit and direct the water flow in a trajectory that is parallel or nearly parallel to the front of the unit. The bowl shall be 165.1 mm (6-1/2 inches) high, made of corrosion resisting steel and be for interior installation.

P-6 SERVICE SINK:

Enameled cast iron ASME A112.19.1M, copper alloy or stainless steel ASME A112.19.3M wall mounted 609.6 mm wide x 508.0 mm deep (24 inches wide x 20 inches deep), splashback 228.6 mm (9 inches) high.

In Barracks Building Only: Enameled cast iron ASME A112.19.1M, copper alloy or stainless steel ASME A112.19.3M corner, floor mounted 711.2 mm (28 inches)square, 171.5 mm (6-3/4 inches)deep.

Faucet and Spout - Cast or wrought copper alloy, with top or bottom brace, with backflow preventer. Faucets shall have replaceable seat and the washer shall rotate onto the seat. Handles shall be lever type. Strainers shall have internal threads.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc. shall be copper alloy or stainless steel.

Trap - Cast iron, minimum 7.5 cm diameter.

P-7 HAND SINK

Countertop with holes for faucet and spout 609.6 mm by 533.4 mm stainless steel.

Faucet - Faucets shall be center set type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. Flow shall be limited to 0.16 liters per

second at a flowing pressure of 549 kPa. Spout shall be gooseneck type.

Handles - Index turn type. Cast, formed, or drop forged copper alloy.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc. shall be copper alloy or stainless steel.

Trap - Cast iron.

P-7A KITCHENETTE SINK

Double bowl, countertop with holes for faucet and spout 838.2 mm by 558.8 mm by 203.2 mm stainless steel.

Faucet - Faucets shall be center set type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. Flow shall be limited to 0.16 liters per second at a flowing pressure of 549 kPa. Spout shall be gooseneck type.

Handles - Index turn type. Cast, formed, or drop forged copper alloy.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc. shall be copper alloy or stainless steel.

Trap - Cast iron.

P-8 WALL HYDRANT:

See paragraph WALL HYDRANTS.

P-9 BATHTUB WITH SHOWER:

Straight front, recessed, 1.524 m x 812.8 mm x 406.4 mm (60 x 32 x 16 in), enameled cast iron, ASME A112.19.1M raised bottom.

Drain Assembly - Plug, cup strainer, overflow assembly, washers, couplings, pop-up lever, trip lever, stopper, fittings, etc., shall be brass, cast copper alloy, or wrought copper alloy. See paragraph FIXTURES for optional plastic accessories.

Bath Showers: Bath showers shall include bathtub spout, shower head, valves, diverters. A shower head mounting with ball joint and head integral with a formed wall plate shall be provided. Diverter shall be integral with single mixing valves or mounted hot and cold water valves. Tub spout shall be copper alloy.

P-10 WASHING MACHINE CONNECTOR BOX:

Provide recessed wall box fabricated of aluminum, PVC plastic, stainless steel, or hot-dip galvanized steel. Provide hot-dip galvanized steel with epoxy or baked-on enamel finish. Provide drain nipple and locknut with cover nut for locking drain outlet to box. Provide brass pipe fittings for connecting each supply pipe to valve and locking to box. Provide hot water and cold water supply valves similar to hose bibs.

P-11 LAUNDRY SINK:

Double bowl, pedestal 1219 x 508.0 mm (48 x 20 inches) or leg support 1219 x 508.0 mm (48 x 20 inches), stainless steel ASME A112.19.3M.

Faucet and Spout - Cast copper alloy, wrought copper alloy, cast iron, or stainless steel, with backflow preventer. Faucets shall have replaceable seat and the stem shall rotate onto the seat. Strainers shall have internal threads. Combination faucets shall be mounted on the tub back. Spouts shall be externally threaded for hose connection. Faucet shall be aerated.

Handles - Cast copper alloy, wrought copper alloy, or stainless steel, lever type.

Traps - Copper alloy, or cast iron.

P-12 MUD ROOM FIXTURE:

Single temperature, hot or cold, heavy duty wash down station. Station shall include 80 mm cast bronze globe valve with renewable disc, nickel alloy seat, and integral wall bracket. Assembly shall also include minimum 1800 mm long, 80 mm diameter heavy duty hose with bronze couplings, stainless steel hose rack with 15 mm bar and rear-trigger water gun with swivel.

P-13 BUBBLER DRINKING FOUNTAINS:

Bubbler drinking fountains shall have self-closing valves. Self-closing valves shall have automatic stream regulators, flow control capability, a push button actuation or a cross-shaped index metal turn handle without a hood. Spouts shall provide a flow of water at least 100 mm (4 inches)high so as to allow the insertion of a cup or glass under the flow of water. Stops, stream regulators, flow controls, pushbuttons, handles, and traps shall be made of copper zinc alloy. Strainers and drains shall be made of copper zinc alloy or stainless steel.

Surface Wall-Mounted - Surface wall-mounted units shall be 336.6 mm (13-1/4 inches) wide, 330.2 mm (13 inches) deep. The bowl shall be made of corrosion-resisting steel. The unit shall have concealed fasteners and be for exterior installation.

3.11 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.12 PERFORMANCE OF WATER HEATING EQUIPMENT

Standard rating condition terms are as follows:

EF = Energy factor, overall efficiency.

ET = Thermal efficiency with 21 degrees C delta T.

EC = Combustion efficiency, 100 percent - flue loss when smoke = o (trace is permitted).

SL = Standby loss in W/0.093 sq. m.based on 27 degrees C delta T, or in percent per hour based on nominal 38 degrees

SAFETY PAYS

C delta T.

HL = Heat loss of tank surface area.

V = Storage volume in liters

3.12.1 Storage Water Heaters

3.12.1.1 NOT USED

3.12.1.2 Gas

a. Storage capacity of 379 liters or less, and input rating of 21980 W or less: minimum EF shall be 0.62-0.0019V per 10 CFR 430.

b. Storage capacity of more than 379 liters - or input rating more than 21980 W: ET shall be 77 percent; maximum SL shall be 1.3+38/V, per ANSI Z21.10.3.

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE					
Item #	Pipe and Fitting Materials	A	B	C	D	E	F
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets	X	X	X	X	X	
2	Cast iron pipe and fittings hubless, CISPI 301 and ASTM A 888	X	X	X	X		
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 6	X		X	X		
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 6				X	X	
5	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 6				X	X	
6	Steel pipe, seamless galvanized, ASTM A 53, Type S, Grade B	X		X	X		
7	Seamless red brass pipe, ASTM B 43			X	X		

8	Bronzed flanged fittings, ASME B16.24 for use with Items 7 and 10				X	X	
9	Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 10				X	X	
10	Seamless copper pipe, ASTM B 42				X		
11	Cast bronze threaded fittings, ASME B16.15				X	X	
12	Copper drainage tube, (DWV), ASTM B 306	X*	X	X*	X	X	
13	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X	
14	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X	
15	Acrylonitrile-Butadiene-Styrene (ABS) plastic drain, waste, and vent pipe and fittings ASTM D 2661, ASTM F 628	X	X	X	X	X	X
16	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D 2665, ASTM F 891, (Sch 40)	X	X	X	X	X	X

SERVICE:
A - Underground Building Soil, Waste and Storm Drain
B - Aboveground Soil, Waste, Drain In Buildings
C - Underground Vent
D - Aboveground Vent
E - Interior Rainwater Conductors Aboveground
F - Corrosive Waste And Vent Above And Belowground
* - Hard Temper

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

		SERVICE			
Item No.	Pipe and Fitting Materials	A	B	C	D

SAFETY PAYS

1	Malleable-iron threaded fittings, a. Galvanized, ASME B16.3 for use with Item 2a	X	X	X	X
	b. Same as "a" but not galvanized for use with Item 2b			X	
2	Steel pipe: a. Seamless, galvanized, ASTM A 53, Type S, Grade B	X	X	X	X
	b. Seamless, black, ASTM A 53, Type S, Grade B			X	
3	Seamless red brass pipe, ASTM B 43	X	X		X
4	Bronze flanged fittings, ASME B16.24 for use with Item 2	X	X		X
5	Seamless copper pipe, ASTM B 42	X	X		X
6	Seamless copper water tube, ASTM B 88	X**	X**	X**	X***
7	Seamless and welded copper distribution tube (Type D) ASTM B 641	X**	X**	X**	X****
8	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 6	X	X		X
9	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5 and 6	X	X	X	X
10	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Items 5 and 6	X	X	X	X
11	Polyethylene (PE) plastic pipe, Schedules 40 and 80, based on outside diameter ASTM D 2447	X		X	
12	Polyethylene (PE) plastic pipe (SDR-PR), based on controlled outside diameter, ASTM D 3035	X		X	

13	Polyethylene (PE) plastic pipe (SIDR-PR), based on controlled inside diameter, ASTM D 2239	X		X	
14	Butt fusion polyethylene (PE) plastic pipe fittings, ASTM D 3261 for use with Items 10 and 13	X		X	
15	Polyethylene (PE) plastic tubing, ASTM D 2737	X		X	
16	Chlorinated polyvinyl chloride (CPVC) plastic hot and cold water distribution system, ASTM D 2846	X	X		X
17	Chlorinated polyvinyl chloride (CPVC) plastic pipe, Schedule 40 and 80, ASTM F 441	X			X
18	Chlorinated polyvinyl chloride (CPVC) plastic pipe (SDR-PR) ASTM F 442	X			X
19	Threaded chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 80, ASTM F 437, for use with Items 16, and 17	X	X		X
20	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F 438 for use with Item 19	X	X		X
21	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F 439 for use with Item 19	X	X		X
22	Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80, and 120, ASTM D 1785	X			X
23	Polyvinyl chloride (PVC) pressure-rated pipe (SDR Series), ASTM D 2241	X			X
24	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D 2466	X			X
25	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, schedule 80,	X			X

	ASTM D 2467				
26	Threaded polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D 2464	X			X
27	Joints for IPS pvs pipe using solvent cement, ASTM D 2672	X			X
28	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D 2996	X	X		
29	Steel pipeline flanges, MSS SP-44	X	X		
30	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B 828	X	X		
31	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X	X	
32	Malleable-iron threaded pipe unions ASME B16.39	X	X		
33	Nipples, pipe threaded ASTM A 733	X	X	X	

A - Cold Water Aboveground

B - Hot Water 82 degree CMaximum Aboveground

C - Compressed Air Lubricated

D - Cold Water Service Belowground

Indicated types are minimum wall thicknesses.

** - Type L - Hard

*** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors

**** - In or under slab floors only brazed joints

TABLE III
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT

A. STORAGE WATER HEATERS

SAFETY PAYS

FUEL	STORAGE CAPACITY LITERS	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE
Gas	380 max.	22 kW max.	10 CFR 430	EF = 0.62-0.0019V minimum
Gas	380 min. OR	22 kW min.	ANSI Z21.10.3	ET= 77 percent; SL = 1.3+38/V max.

TERMS:

EF = Energy factor, overall efficiency.
ET = Thermal efficiency with 21 degrees C delta T.
EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).
SL = Standby loss in W/0.09 sq. m. based on 27 degrees C delta T, or in percent per hour based on nominal 32 degrees C delta T.
HL = Heat loss of tank surface area
V = Storage volume in gallons

--END OF SECTION--

SECTION 15400

PLUMBING, GENERAL PURPOSE

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SUBMITTAL REGISTER (ER415-1-10)	CONTRACT NO.
TITLE AND LOCATION Discom Barracks Complex, Phase I Ft. Campbell, Kentucky	CONTRACTOR / SPEC. SECTION 15400

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.5 SUBMITTALS										
			SD-01 Data										
			Welding; FIO.										
			Vibration-Absorbing Features; FIO.										
			SD-04 Drawings										
			Plumbing System; GA.										
			Electrical Schematics; FIO.										
			SD-06 Instructions										
			Plumbing System; FIO.										
			SD-09 Reports										
			Tests, Flushing and Sterilization; FIO.										
			Backflow Prevention Assembly Tests; FIO.										
			SD-13 Certificates										
			Materials and Equipment; FIO.										
			Bolts; FIO.										
			SD-19 Operation and Maintenance Manuals										
			Plumbing System; FIO.										

SAFETY PAYS

SECTION 15488

GAS PIPING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN GAS ASSOCIATION (AGA)

AGA-01	(1989) A.G.A. Plastic Pipe Manual for Gas Service

AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI Z21.45	(1992; Z21.4a; Z21.4b) Flexible Connectors of Other Than All-Metal Construction for Gas Appliances
ANSI Z21.69	(1992; Z21.69a) Connectors for Movable Gas Appliances

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D	(1994) Specification for Pipeline Valves (Gate, Plug, Ball, and Check Valves)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 539	(1990a) Electric-Resistance-Welded Coiled Steel Tubing for Gas and Fuel Oil Lines
ASTM B 88	(1995a) Seamless Copper Water Tube
ASTM B 210	(1995) Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B 241	(1995a) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 280	(1993a) Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM D 2513	(1995c) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D 2517	(1981; R 1987) Reinforced Epoxy Resin Gas Pressure Pipe and Fittings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.5	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.33	(1990) Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (Sizes 1/2 through 2)
ASME B31.1	(1995) Power Piping
ASME B31.2	(1968) Fuel Gas Piping
ASME B36.10M	(1985; R 1994) Welded and Seamless Wrought Steel Pipe
ASME BPV IX	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGSINDUSTRY (MSS)

MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(1996) National Fuel Gas Code
NFPA 70	(1996) National Electrical Code

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 6	(1994) Commercial Blast Cleaning

UNDERWRITERS LABORATORIES (UL)

UL-06 (1994; Supple; Rev thru March 1996) Gas and Oil Equipment Directory

1.2 GENERAL REQUIREMENTS

1.2.1 Welding

Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified at least 24 hours in advance of tests and the tests shall be performed at the work site if practicable. The Contracting Officer shall be furnished with a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section 05055 WELDING, STRUCTURAL.

1.2.2 Jointing Thermoplastic and Fiberglass Piping

Piping shall be jointed by performance qualified joiners using qualified procedures in accordance with AGA-01. Plastic Pipe Manual for Gas Service. The Contracting Officer shall be furnished with a copy of qualified procedures and list of and identification symbols of qualified joiners.

1.2.3 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos shall not be used. Manufacturer's descriptive data and installation instructions shall be submitted for approval for compression-type mechanical joints used in joining dissimilar materials and for insulating joints. Valves, flanges and fittings shall be marked in accordance with MSS SP-25.

1.2.4 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Qualifications; FIO.

Qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

SD-04 Drawings

Gas Piping System; GA.

Drawings showing location, size and all branches of pipeline; location of all required shutoff valves; and instructions necessary for the installation of connectors and supports.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

2.1.1 Steel Pipe, Joints, and Fittings

Steel pipe shall conform to ASME B36.10M. Malleable-iron threaded fittings shall conform to ASME B16.3. Steel pipe flanges and flanged fittings including bolts, nuts, and bolt pattern shall be in accordance with ASME B16.5. Wrought steel buttwelding fittings shall conform to ASME B16.9. Socket welding and threaded forged steel fittings shall conform to ASME B16.11.

2.1.2 NOT USED

2.1.3 Copper Tubing, Joints and Fittings

Copper tubing shall conform to ASTM B 88, Type K or L, or ASTM B 280. Tubing joints shall be made up with tubing fittings recommended by the tubing manufacturer.

2.1.4 Steel Tubing, Joints and Fittings

Steel tubing shall conform to ASTM A 539. Tubing joints shall be made up with gas tubing fittings recommended by the tubing manufacturer.

2.1.5 Thermoplastic Pipe, Tubing, Joints, and Fittings

Thermoplastic pipe, tubing, joints and fittings shall conform to ASTM D 2513.

2.1.6 Fiberglass Pipe, Joints, and Fittings

Fiberglass piping systems shall conform to ASTM D 2517.

2.1.7 Sealants for Steel Pipe Threaded Joints

Joint sealing compound shall be listed in UL-06, Class 20 or less. Tetrafluoroethylene tape shall conform to UL-06.

2.1.8 Identification

Pipe flow markings and metal tags shall be provided as required.

2.1.9 Flange Gaskets

Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1.6 mm (1/16 inch) thickness, full face or self-centering flat ring type. The gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR) suitable for a maximum 316 degrees C (600 degrees F) service. NBR binder shall be used for hydrocarbon service.

2.1.10 Pipe Threads

Pipe threads shall conform to ASME B1.20.1.

2.1.11 Escutcheons

Escutcheons shall be chromium-plated steel or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or set screw.

2.1.12 Gas Transition Fittings

Gas transition fittings shall be manufactured steel fittings approved for jointing metallic and thermoplastic or fiberglass pipe. Approved transition fittings are those that conform to AGA-01 requirements for transitions fittings.

2.1.13 Insulating Pipe Joints

2.1.13.1 Insulating Joint Material

Insulating joint material shall be provided between flanged or threaded metallic pipe systems where shown to control galvanic or electrical action.

2.1.13.2 Threaded Pipe Joints

Joints for threaded pipe shall be steel body nut type dielectric unions with insulating gaskets.

2.1.13.3 Flanged Pipe Joints

Joints for flanged pipe shall consist of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts, and insulating washers for flange nuts.

2.1.14 Flexible Connectors

Flexible connectors for connecting gas utilization equipment to building gas piping shall conform to ANSI Z21.45. Flexible connectors for movable food service equipment shall conform to ANSI Z21.69.

2.2 VALVES

Valves shall be suitable for shutoff or isolation service and shall conform to the following:

2.2.1 Valves 50 mm (2 Inches) and Smaller

Valves 50 mm (2 inches) and smaller shall conform to ASME B16.33 and shall be of materials and manufacture compatible with system materials used.

2.2.2 Valves 65 mm (2-1/2 Inches) and Larger

Valves 65 mm (2-1/2 inches) and larger shall be carbon steel conforming to API Spec 6D, Class 150.

2.3 PIPE HANGERS AND SUPPORTS

Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69.

2.4 METERS, REGULATORS AND SHUTOFF VALVES

Meters, regulators and shutoff valves shall be as specified in Section 02685 GAS DISTRIBUTION SYSTEM.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILLING

Earthwork shall be as specified in Section 02316 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2 GAS PIPING SYSTEM

Gas piping system shall be from the point of delivery, defined as the outlet of the meter set assembly, specified in Section 02685 GAS DISTRIBUTION SYSTEM, to the connections to each gas utilization device.

3.2.1 Protection of Materials and Components

Pipe and tube openings shall be closed with caps or plugs during installation. Equipment shall be protected from dirt, water, and chemical or mechanical damage. At the completion of all work, the entire system shall be thoroughly cleaned.

3.2.2 Workmanship and Defects

Piping, tubing and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and chip-and scale-blown. Defects in piping, tubing or fittings shall not be repaired. When defective piping, tubing, or fittings are located in a system, the defective material shall be replaced.

3.3 PROTECTIVE COVERING

3.3.1 Underground Metallic Pipe

Buried metallic piping shall be protected from corrosion with protective coatings as specified in Section 02685 GAS DISTRIBUTION SYSTEM. When dissimilar metals are joined underground, gastight insulating fittings shall be used.

3.3.2 Aboveground Metallic Piping Systems

3.3.2.1 Ferrous Surfaces

Shop primed surfaces shall be touched up with ferrous metal primer. Surfaces that have not been shop primed shall be solvent cleaned. Surfaces that contain loose rust, loose mill scale and other foreign substances shall be mechanically cleaned by power wire brushing or commercial sand blasted conforming to SSPC SP 6 and primed with ferrous metal primer or vinyl type wash coat. Primed surface shall be finished with two coats of exterior oil paint or vinyl paint.

3.3.2.2 Nonferrous Surfaces

Except for aluminum alloy pipe, nonferrous surfaces shall not be painted. Surfaces of aluminum alloy pipe and fittings shall be painted to protect against external corrosion where they contact masonry, plaster, insulation, or are subject to repeated wettings by such liquids as water, detergents or sewage. The surfaces shall be solvent-cleaned and treated with vinyl type wash coat. A first coat of aluminum paint and a second coat of alkyd gloss enamel or silicone alkyd

copolymer enamel shall be applied.

3.4 INSTALLATION

Installation of the gas system shall be in conformance with the manufacturer's recommendations and applicable provisions of NFPA 54, AGA-01, and as indicated. Pipe cutting shall be done without damage to the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable. On steel pipe 150 mm (6 inches) and larger, an approved gas cutting and beveling machine may be used. Cutting of thermoplastic and fiberglass pipe shall be in accordance with AGA-01.

3.4.1 Metallic Piping Installation

Underground piping shall be buried a minimum of 450 mm below grade. Changes in direction of piping shall be made with fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Aluminum alloy pipe shall not be used in exterior locations or underground.

3.4.2 Metallic Tubing Installation

Metallic tubing shall be installed using gas tubing fittings approved by the tubing manufacturer. Branch connections shall be made with tees. All tubing end preparation shall be made with tools designed for the purpose. Aluminum alloy tubing shall not be used in exterior locations or underground.

3.4.3 Thermoplastic and Fiberglass Piping, Tubing, and Fittings

Thermoplastic and fiberglass piping, tubing, and fittings shall be installed outside and underground only. Piping shall be buried a minimum of 18 inches below grade. The piping shall be installed to avoid excessive stresses due to thermal contraction. Thermoplastic and fiberglass piping shall only be allowed as indicated.

3.4.4 Connections Between Metallic and Plastic Piping

Connections shall be made only outside, underground, and with approved transition fittings.

3.4.5 Piping Buried Under Buildings

Underground piping installed beneath buildings shall be run in a steel pipe casing protected from corrosion with protective coatings as specified in Section 02685 GAS DISTRIBUTION SYSTEM. The casing shall extend at least 100 mmoutside the building. The pipe shall have spacers and end bushings to seal at both ends to prevent the entrance of water and escape of gas. A vent line from the annular space shall extend above grade outside to a point where gas will not be a hazard and shall terminate in a rain- and insect-resistant fitting.

3.4.6 Concealed Piping in Buildings

When installing piping which is to be concealed, unions, tubing fittings, running threads, right- and left-hand couplings, bushings, and swing joints made by combinations of fittings shall not be used.

3.4.6.1 Piping in Partitions

Concealed piping shall be located in hollow rather than solid partitions. Tubing passing through walls or partitions shall

be protected against physical damage.

3.4.6.2 Piping in Floors

Piping in solid floors except where embedment in concrete is indicated shall be laid in channels suitably covered to permit access to the piping with minimum damage to the building. Piping embedded in concrete shall be surrounded by a minimum of 40 mm of concrete and shall not be in physical contact with other metallic items such as reinforcing rods or electrically neutral conductors. Piping shall not be embedded in concrete slabs containing quickset additives or cinder aggregate.

3.4.7 Aboveground Piping

Aboveground piping shall be run as straight as practicable along the alignment indicated and with a minimum of joints. Piping shall be separately supported. Exposed horizontal piping shall not be installed farther than 150 mm from nearest parallel wall in laundry areas where clothes hanging could be attempted.

3.4.8 Final Gas Connections

Unless otherwise specified herein, final connections shall be made with rigid metallic pipe and fittings. Flexible connectors may be used for final connections to gas utilization equipment. In addition to cautions listed in instructions required by ANSI standards for flexible connectors, insure that flexible connectors do not pass through equipment cabinet.Provide accessible gas shutoff valve and coupling for each gas equipment item.

3.5 PIPE JOINTS

Pipe joints shall be designed and installed to effectively sustain the longitudinal pull-out forces caused by contraction of the piping or superimposed loads.

3.5.1 Threaded Metallic Joints

Threaded joints in metallic pipe shall have tapered threads evenly cut and shall be made with UL approved graphite joint sealing compound for gas service or tetrafluoroethylene tape applied to the male threads only. Threaded joints up to 40 mm in diameter may be made with approved tetrafluoroethylene tape. Threaded joints up to 50 mm in diameter may be made with approved joint sealing compound. After cutting and before threading, pipe shall be reamed and burrs shall be removed. Caulking of threaded joints to stop or prevent leaks shall not be permitted.

3.5.2 Welded Metallic Joints

Beveling, alignment, heat treatment, and inspection of welds shall conform to ASME B31.2. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected adversely. Electrodes that have been wetted or have lost any of their coating shall not be used.

3.5.3 Thermoplastic and Fiberglass Joints

Jointing procedures shall conform to AGA-01. Solvent cement or heat of fusion joints shall not be made between different kinds of plastics.

3.5.4 Flared Metallic Tubing Joints

Flared joints in metallic tubing shall be made with special tools recommended by the tubing manufacturer. Flared joints shall be used only in systems constructed from nonferrous pipe and tubing, when experience or tests have demonstrated that the joint is suitable for the conditions, and when adequate provisions are made in the design to prevent separation of the joints. Metallic ball sleeve compression-type tubing fittings shall not be used for tubing joints.

3.5.5 Solder or Brazed Joints

Joints in metallic tubing and fittings shall be made with materials and procedures recommended by the tubing supplier. Joints shall be brazed with material having a melting point above 538 degrees C (1000 degrees F). Brazing alloys shall not contain phosphorous.

3.5.6 Joining Thermoplastic or Fiberglass to Metallic Piping or Tubing

When compression type mechanical joints are used, the gasket material in the fittings shall be compatible with the plastic piping and with the gas in the system. An internal tubular rigid stiffener shall be used in conjunction with the fitting, and the stiffener shall be flush with end of the pipe or tubing and shall extend at least to the outside end of the compression fitting when installed. The stiffener shall be free of rough or sharp edges and shall not be a force fit in the plastic. A split tubular stiffener shall not be used.

3.6 PIPE SLEEVES

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be installed in structural members except where indicated or approved. All rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor or roof, and shall be cut flush with each surface, except in mechanical room floors not located on grade where clamping flanges or riser pipe clamps are used. Sleeves in mechanical room floors above grade shall extend at least 100 mm above finish floor. Unless otherwise indicated, sleeves shall be large enough to provide a minimum clearance of 6.4 mm all around the pipe. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe. Sleeves in nonbearing walls, floors, or ceilings may be steel pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. For penetrations of fire walls, fire partitions and floors which are not on grade, the annular space between the pipe and sleeve shall be sealed with firestopping material and sealant that meet the requirement of Section 07270 FIRESTOPPING.

3.7 PIPES PENETRATING WATERPROOFING MEMBRANES

Pipes penetrating waterproofing membranes shall be installed as specified in Section 15400 PLUMBING, GENERAL PURPOSE.

3.8 FIRE SEAL

Penetrations of fire rated partitions, walls and floors shall be in accordance with Section 07270 FIRESTOPPING.

3.9 ESCUTCHEONS

Escutcheons shall be provided for all finished surfaces where gas piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms.

3.10 SPECIAL REQUIREMENTS

Drips, grading of the lines, freeze protection, and branch outlet locations shall be as shown and shall conform to the

requirements of NFPA 54.

3.11 BUILDING STRUCTURE

Building structure shall not be weakened by the installation of any gas piping. Beams or joists shall not be cut or notched.

3.12 PIPING SYSTEM SUPPORTS

Gas piping systems in buildings shall be supported with pipe hooks, metal pipe straps, bands or hangers suitable for the size of piping or tubing. Gas piping system shall not be supported by other piping. Spacing of supports in gas piping and tubing installations shall conform to the requirements of NFPA 54. The selection and application of supports in gas piping and tubing installations shall conform to the requirements of MSS SP-69. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for any of the individual pipes in the multiple pipe run. The clips or clamps shall be rigidly connected to the common base member. A clearance of 3.2 mm shall be provided between the pipe and clip or clamp for all piping which may be subjected to thermal expansion.

3.13 ELECTRICAL BONDING AND GROUNDING

A gas piping system within a building shall be electrically continuous and bonded to a grounding electrode as required by NFPA 70.

3.14 SHUTOFF VALVE

Main gas shutoff valve controlling the gas piping system shall be easily accessible for operation and shall be installed as indicated, protected from physical damage, and marked with a metal tag to clearly identify the piping system controlled.

3.15 CATHODIC PROTECTION

Cathodic protection shall be provided for underground ferrous gas piping as specified in Section 16640 CATHODIC PROTECTION SYSTEM SACRIFICIAL ANODE.

3.16 TESTING

Before any section of a gas piping system is put into service, it shall be carefully tested to assure that it is gastight. Prior to testing, the system shall be blown out, cleaned and cleared of all foreign material. Each joint shall be tested by means of an approved gas detector, soap and water, or an equivalent nonflammable solution. Testing shall be completed before any work is covered, enclosed, or concealed. All testing of piping systems shall be done with due regard for the safety of employees and the public during the test. Bulkheads, anchorage and bracing suitably designed to resist test pressures shall be installed if necessary. Oxygen shall not be used as a testing medium.

3.16.1 Pressure Tests

Before appliances are connected, piping systems shall be filled with air or an inert gas and shall withstand a minimum pressure of 21 kPa (3 psi) gauge for a period of not less than 10 minutes as specified in NFPA 54 without showing any drop in pressure. Oxygen shall not be used. Pressure shall be measured with a mercury manometer, slope gauge, or an equivalent device so calibrated as to be read in increments of not greater than 1 kPa (0.1 pound). The source of pressure shall be isolated before the pressure tests are made.

SAFETY PAYS

3.16.2 NOT USED

3.16.3 Test With Gas

Before turning gas under pressure into any piping, all openings from which gas can escape shall be closed. Immediately after turning on the gas, the piping system shall be checked for leakage by using a laboratory-certified gas meter, an appliance orifice, a manometer, or equivalent device. All testing shall conform to the requirements of NFPA 54. If leakage is recorded, the gas supply shall be shut off, the leak shall be repaired, and the tests repeated until all leaks have been stopped.

3.16.4 Purging

After testing is completed, and before connecting any appliances, all gas piping shall be fully purged. LPG piping tested using fuel gas with appliances connected does not require purging. Piping shall not be purged into the combustion chamber of an appliance. The open end of piping systems being purged shall not discharge into confined spaces or areas where there are ignition sources unless the safety precautions recommended in NFPA 54 are followed.

3.16.5 Labor, Materials and Equipment

All labor, materials and equipment necessary for conducting the testing and purging shall be furnished by the Contractor.

--END OF SECTION--

SECTION 15488

GAS PIPING SYSTEMS

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			Qualifications; FIO.										
			SD-04 Drawings										
			Gas Piping System; GA.										

SAFETY PAYS

SECTION 15556

FORCED HOT WATER HEATING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designations only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1990) Ferritic Malleable Iron Castings
ASTM A 53	(1990b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 105	(1992) Forgings, Carbon Steel, for Piping Components
ASTM A 106	(1991) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 183	(1983; R 1990) Carbon Steel Track Bolts and Nuts
ASTM A 193	(1992) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 234	(1992a) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A 366	(1991) Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A 515	(1990) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516	(1990) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 525	(1991b) General Requirement for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 527	(1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
ASTM A 528	(1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Drawing

	Quality
ASTM A 536	(1984) Ductile Iron Castings
ASTM A 569	(1991a) Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality
ASTM A 642	(1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Drawing Quality, Special Killed
ASTM A 733	(1989) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B 32	(1993) Solder Metal
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1992a) Seamless Copper Tube
ASTM B 88	(1993) Seamless Copper Water Tube
ASTM B 251	(1993) Wrought Seamless Copper and Copper-Alloy Tube
ASTM B 265	(1993) Titanium and Titanium Alloy Strip, Sheet, and Plate
ASTM B 333	(1992) Nickel-Molybdenum Alloy Plate, Sheet, and Strip
ASTM B 395	(1993) U-Bend Seamless Copper and Copper Alloy Heat Exchanger and Condenser Tubes
ASTM B 424	(1993) Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825 and UNS N08221) Plate, Sheet, and Strip
ASTM B 650	(1985) Electrodeposited Engineering Chromium Coatings of Ferrous Substrates
ASTM B 687	(1988) Brass, Copper, and Chromium-Plated Pipe Nipples
ASTM B 828	(1992) Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM D 596	(1991) Reporting Results of Analysis of Water
ASTM D 1248	(1984, R 1989) Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1384	(1987) Corrosion Test for Engine Coolants in Glassware
ASTM D 2000	(1990) Rubber Products in Automotive Applications

ASTM D 3308	(1991a) PTFE Resin Skived Tape

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1992) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(1992) Cast Iron Threaded Fittings Classes 125 and 250
ASME B16.5	(1988; Errata; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(1984) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(1986; R 1994) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B16.34	(1988) Valves - Flanged, Threaded, and Welding End
ASME B31.1	(1992; B31.1a; B31.1b) Power Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV VIII Div 1	(1992; Addenda Dec 1992, Dec 1993) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPV IX	(1992; Addenda Dec 1992, Dec 1993) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606	(1987) Grooved and Shouldered Joints

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding

EXPANSION JOINT MANUFACTURERS ASSOCIATION (EJMA)

EJMA-01	(1980; Addenda 1985) EJMA Standards

HYDRONICS INSTITUTE (HYI)

HYI-01	(1992; Addenda Jan 1992) I=B=R Ratings for Boilers, Baseboard Radiation and Finned Tube (Commercial) Radiation

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGSINDUSTRY (MSS)

MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1988) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1990) Cast Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(1985) Cast Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS(NAPHCC)

NAPHCC-01	(1993) National Standard Plumbing Code (Non-Illustrated Edition

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for

information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Spare Parts; FIO.

Spare parts data for each different item of material and equipment specified , after approval of the related submittals and not later than 1 month prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Heating System; GA.

Detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-06 Instructions

Framed Instructions; FIO.

Proposed diagrams, instructions, and other sheets, prior to posting. The instructions shall show wiring and control diagrams and complete layout of the entire system. The instructions shall include, in typed form, condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation and procedures for safely starting and stopping the system.

SD-09 Reports

Performance Tests; FIO.

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-13 Certificates

Bolts; FIO.

Written certification that the bolts furnished comply with the requirements of this specification, provided by the bolt manufacturer. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

SD-19 Operation and Maintenance Manuals

Heating System; FIO.

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set, prior to performance testing and the remainder upon acceptance. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, water treatment procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed. Manuals shall be provided prior to the field training course.

1.3 NOT USED

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

PART 2 PRODUCTS

2.1 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.2 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.1.3 Equipment Guards and Access

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded in accordance with OSHA requirements.

2.1.4 Asbestos Prohibition

Asbestos and asbestos-containing products shall not be used.

2.1.5 Electrical Work

Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electric equipment (including motor efficiencies), and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Standard motors shall be used. Electrical characteristics shall be as specified or indicated. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring, conduit, and connection to power required for controls and devices but not shown shall be provided.

2.2 PIPING, TUBING, AND FITTINGS

Piping, tubing, and fittings, shall be as specified in Section 15569, WATER HEATING; GAS; UP TO 20 MBTUH.

2.3 MATERIALS AND ACCESSORIES

Materials and accessories shall be as specified in Section 15569, WATER HEATING; GAS; UP TO 20 MBTUH

2.4 VALVES FOR LOW TEMPERATURE WATER HEATING SYSTEMS

Valves shall be as specified in Section 15569, WATER HEATING; GAS; UP TO 20 MBTUH.

2.5 thru 2.11 NOT USED

2.12 SYSTEM EQUIPMENT AND ACCESSORIES

2.12.1 Circulating Pumps

Pumps shall be as specified in Section 15569, WATER HEATING; GAS; UP TO 20 MBTUH.

2.12.2 NOT USED

2.12.3 Pressure Gauges and Thermometers

Gauges shall be provided for each heat exchanger and piping as indicated. A thermometer and pressure gauge shall be provided on the high temperature water supply and return mains. Thermometers shall be separable socket type.

2.13 INSULATION

Shop and field applied insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.14 FACTORY PAINTED EXPOSED SPACE HEATING EQUIPMENT

All exposed heating equipment shall be painted at the factory with the manufacturer's standard primer and enamel finish.

2.15 NOT USED

2.16 UNIT HEATERS

Heaters shall be as specified below, and shall have a heating capacity not in excess of 125 percent of the capacity indicated.

2.16.1 Propeller Fan Heaters

Heaters shall be designed for suspension and arranged for horizontal or vertical discharge of air as indicated. Casings shall be not less than 0.912 mm (20 gauge) black steel and finished with lacquer or enamel. Suitable stationary deflectors shall be provided to assure proper air and heat penetration capacity at floor level based on established design temperature. Suspension from heating pipes will not be permitted. Horizontal discharge type unit heaters shall have discharge or face velocities not in excess of the following:

Unit Capacity, Liters per Second	Face Velocity, Meters per Second
Up to 472 (1000)	4.06 (800)

2.16.2 NOT USED

2.16.3 Heating Elements

Heating coils shall be as specified in Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM for types indicated. Coils shall be suitable for use with water up to 121 degrees C (250 degrees F).

2.16.4 Motors

Motors shall be provided with NEMA 250 general purpose enclosure. Motors and motor controls shall otherwise be as specified in Section 16415 ELECTRICAL WORK, INTERIOR.

2.16.5 Motor Switches

Motors shall be provided with manual selection switches with "Off," and "Automatic" positions and shall be equipped with thermal overload protection.

2.16.6 Controls

Controls shall be provided as specified in Section 15950 HEATING, VENTILATING, AND AIR CONDITIONING HVAC CONTROL SYSTEMS.

2.17 NOT USED

2.18 WATER TREATMENT SYSTEM

The water treatment system shall be as specified in Section 15569, WATER HEATING; GAS; UP TO 20 MBTUH.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as indicated and in accordance with the manufacturer's diagrams and recommendations.

3.2 FIELD PAINTING

Field painting of exposed pipe shall be as specified in Section 09900 PAINTING, GENERAL. Field painting of factory primed equipment shall be as specified in Section 09900 PAINTING, GENERAL.

3.3 NOT USED

3.4 NOT USED

3.5 CONNECTIONS TO EQUIPMENT

Supply and return connections shall be provided by the Contractor unless otherwise indicated. Valves and traps shall be installed in accordance with the manufacturer's recommendations. Unless otherwise indicated, the size of the supply and return pipes to each piece of equipment shall be not smaller than the connections on the equipment. No bushed connections shall be permitted. Change in sizes shall be made with reducers or increasers only.

3.5.1 Low Temperature Water Connections

Connections, unless otherwise indicated, shall be made with malleable iron unions for piping 65 mm (2-1/2 inches) or less in diameter and with flanges for pipe 80 mm (3 inches) or more in diameter.

3.6 BRANCH CONNECTIONS

Branches shall pitch up or down as indicated, unless otherwise specified. Connection shall be made to insure unrestricted circulation, eliminate air pockets, and permit drainage of the system.

3.6.1 Low Temperature Water Branches

Branches taken from mains shall pitch with a grade of not less than 25 mm in 3 m (1 inch in 10 feet).

3.7 NOT USED

3.8 SUPPORTS

Supports shall be as specified in Section 15569, WATER HEATING; GAS; UP TO 20 MBTUH.

3.9 PIPE SLEEVES

Pipe sleeves shall be as specified in Section 15569, WATER HEATING; GAS; UP TO 20 MBTUH.

3.10 through 3.13 NOT USED

3.14 UNIT HEATERS

Unit heaters shall be installed as indicated and in accordance with the manufacturer's instructions.

3.15 INSULATION

Thickness of insulation materials for piping and equipment and application shall be in accordance with Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.16 TESTING AND CLEANING

Testing and cleaning shall be in accordance with Section 15569, WATER HEATING; GAS; UP TO 20 MBTUH.

3.17 TESTING, ADJUSTING AND BALANCING

Except as specified herein, testing, adjusting, and balancing shall be in accordance with Section 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

3.18 MANUFACTURER'S SERVICES

SAFETY PAYS

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

3.19 FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system.

3.20 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 8 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals.

--END OF SECTION--

SECTION 15556

FORCED HOT WATER HEATING SYSTEMS

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	SPEC. SECTION 15556

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
			Spare Parts; FIO.										
			SD-04 Drawings										
			Heating System; GA.										
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SAFETY PAYS

SECTION 15565

HEATING SYSTEM; GAS-FIRED HEATERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN GAS ASSOCIATION LABORATORIES (AGAL)

AGAL-01	(1995; Supple Dec 95) Directory of Certified Appliances and Accessories

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z83.4	(1991; Z83.4a) Direct Gas-Fired Make-Up Air Heaters

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1993; Rev 1) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(1996) National Fuel Gas Code
NFPA 211	(1996) Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

UNDERWRITERS LABORATORIES (UL)

UL-06	(1995) Gas and Oil Equipment Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Heating System; FIO.

Spare parts data for each different item of materials and equipment specified, after approval of the detail drawings, and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Heating System; FIO.

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of the system. Detail drawings for space heating equipment, controls, associated equipment, and for piping and wiring. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-06 Instructions

Heating System; FIO.

Six complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and basic operating features. Six complete copies of maintenance instructions listing routine maintenance, possible breakdowns, repairs and troubleshooting guide. The instructions shall include simplified piping, wiring, and control diagrams for the system as installed.

SD-09 Reports

Testing, Adjusting, and Balancing; FIO.

Test reports shall be submitted in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

1.3 GENERAL REQUIREMENTS

1.3.1 Nameplates

Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment.

1.3.2 Equipment Guards

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts so located that any person may come in close proximity thereto shall be completely enclosed or guarded. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be guarded or covered with insulation of type specified for service.

1.3.3 Verification of Dimensions

The Contractor shall become thoroughly familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from weather, humidity and temperature variations, dirt and dust, or other contaminants.

SAFETY PAYS

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Material and equipment shall be standard products of a manufacturer regularly engaged in manufacturing of the products. Equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

2.2 ELECTRICAL WORK

Electrical motor driven equipment shall be provided complete with motors, motor starters, and controls. Motors shall conform to NEMA MG 1. Electrical equipment and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Electrical characteristics shall be as specified or indicated. Unless otherwise indicated motors of 745.7 W (1 Hp) and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided.

2.3 HEATERS

Heaters shall be equipped for and adjusted to burn natural gas. Each heater shall be provided with a gas pressure regulator that will satisfactorily limit the main gas burner supply pressure. Heaters shall have an intermittent or interrupted electrically ignited pilot or a direct electric ignition system. Safety controls shall conform to the ANSI standard specified for each heater. Mounting brackets and hardware shall be furnished by the heater manufacturer and shall be factory finished to match the supported equipment.

2.3.1 Direct Fired Make-Up Air Heaters

Heaters shall be in accordance with ANSI Z83.4. Direct fired make-up air heaters use outside air directly ducted to the heater. The products of combustion generated by the heater are released into the outside air stream being heated. Heaters shall be equipped with motorized inlet and outletdampers, duct collar, air filters,and bird screen. Gas control valve shall be modulating type. Maximum air temperature rise during minimum burner fire shall be 4 degrees C (7 degrees F). Outdoor heaters shall be weatherized and shall have manufacturer's standard exterior finish for outdoor units. Motorized inlet and outlet dampers shall be closed when the unit is shut down. Dampers shall be interlocked to prevent burner operation when dampers are closed. Heaters shall be provided with a discharge air thermostat, a low limit air stream thermostat, and an ambient air thermostat. The discharge air thermostat shall control the modulating gas control valve. The low limit air stream thermostat shall shut down the entire unit if the discharge air temperature drops below the discharge thermostat setting. The ambient air thermostat shall shut down the burner if the outside air exceeds the discharge thermostat setting.

2.4 THERMOSTATS

Thermostats shall be the adjustable electric or electronic type. Control wiring required to complete the space temperature control system shall be included. Thermostats shall have a 2 degree C (3 degree F) differential and a set point range of 4 to 24 degree C (40 to 75 degrees F) Thermostats shall be the single stage type.

2.5 NOT USED

2.6 NOT USED

2.7 INSULATION

Insulation for piping and equipment and application shall be in accordance with Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.8 FACTORY FINISHES

Equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish.

PART 3 EXECUTION

3.1 INSTALLATION

Equipment shall be installed as indicated and in accordance with the recommendations of the equipment manufacturer and the listing agency, except as otherwise specified.

3.1.1 Heating Equipment

Heaters shall be installed with clearance to combustibles complying with minimum distances as determined by AGAL-01, UL-06 and as indicated on each heater approval and listing plate. Heaters shall be independently supported from the building structure as indicated and shall not rely on support from suspended ceiling systems.

3.1.2 NOT USED

3.1.3 Gas Piping

Gas piping shall be connected as indicated and shall comply with the applicable requirements at Section 15488 GAS PIPING SYSTEMS.

3.2 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

3.3 Training

The Contractor shall conduct a training course for the maintenance and operating staff. The training period of 2 hours normal working time shall start after the system is functionally complete but before the final acceptance tests. The training shall include all of the items contained in the operating and maintenance instructions as well as demonstrations of routine maintenance operations. The Contracting Officer shall be given at least two weeks advance notice of such training.

--END OF SECTION--

SECTION 15565

HEATING SYSTEM; GAS-FIRED HEATERS

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SUBMITTAL REGISTER (ER415-1-10)	CONTRACT NO.
TITLE AND LOCATION Discom Barracks Complex, Phase I Ft. Campbell, Kentucky	CONTRACTOR
	SPEC. SECTION 15565

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
			SD-01 Data										
			Heating System; FIO.										
			SD-04 Drawings										
			Heating System; FIO.										
			SD-06 Instructions										
			Heating System; FIO.										
			SD-09 Reports										
			Testing, Adjusting, and Balancing; FIO.										

SAFETY PAYS

SECTION 15569

WATER HEATING; GAS; UP TO 20 MBTUH

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA Pub-801	(1992) Industrial Process/Power Generation Fans

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.13	(1991; Z21.13a; Z21.13b) Gas-Fired Low-Pressure Steam and Hot Water Boilers

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1990) Ferritic Malleable Iron Castings
ASTM A 53	(1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 105	(1996) Forgings, Carbon Steel, for Piping Components
ASTM A 106	(1994) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 167	(1993) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 183	(1983, R 1990) Carbon Steel Track Bolts and Nuts
ASTM A 193	(1996) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 234	(1996) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A 366	(1991; R 1993) Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A 515	(1992) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service

ASTM A 516	(1990) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 526	(1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM B 32	(1995) Solder Metal
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1993) Seamless Copper Tube
ASTM B 88	(1993a) Seamless Copper Water Tube
ASTM B 813	(1993) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM B 828	(1992) Making Capillary Joints by Soldering of Copper and Copper-Alloy Tube and Fittings
ASTM C 27	(1993) Fireclay and High-Alumina Refractory Brick
ASTM C 34	(1993) Structural Clay Load-Bearing Wall Tile
ASTM C 155	(1988; R 1992) Classification of Insulating Firebrick
ASTM C 401	(1991) Alumina and Alumina Silicate Castable Refractories
ASTM D 596	(1991) Reporting Results of Analysis of Water
ASTM D 1784	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2000	(1990; R 1994) Rubber Products in Automotive Applications
ASTM F 872	(1984; R 1990) Filter Units, Air Conditioning: Viscous-Impingement Type, Cleanable
ASTM F 1097	(1991) Mortar, Refractory (High-Temperature, Air-Setting)
ASTM F 1139	(1988; R 1993) Standard Specification for Steam Traps and Drains

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.4	(1992) Cast Iron Threaded Fittings
ASME B16.5	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.34	(1988) Valves - Flanged, Threaded and Welding End
ASME B16.39	(1986; R 1994) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B19.3	(1991; B19.3a) Safety Standard for Compressors for Process Industries
ASME B31.1	(1995) Power Piping
ASME B31.5	(1992; B31.5a) Refrigeration Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV IV	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IV, Heating Boilers
ASME BPV VIII Div 1	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPV IX	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

ASME CSD-1	(1992; CSD-1a; CSD1b) Controls and Safety Devices for Automatically Fired Boilers
ASME PTC 10	(1965; R 1992) Compressors and Exhausters

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606	(1987) Grooved and Shouldered Joints

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS B2.2	(1991) Brazing Procedure and Performance Qualification

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1419	(Rev D) Filter Element, Air Conditioning (Viscous-Impingement and Dry Types, Replaceable)

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA 404/0-RR	(1993) Copper Tube for Plumbing, Heating, Air Conditioning and Refrigeration

EXPASION JOINT MANUFACTURERS ASSOCIATION (EJMA)

EJMA-01	(1993) EJMA Standards

HYDRONICS INSTITUTE (HYI)

HYI-IBR Ratings	(1994) I=B=R Ratings for Boilers, Baseboard Radiation and Finned Tube (Commercial) Radiation

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGSINDUSTRY (MSS)

MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1990) Cast Iron Swing Check Valves, Flanges and Threaded Ends

MSS SP-72	(1992) Ball Valves with Flanged or Buttwelding Ends for General Service
MSS SP-73	(1991) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-78	(1987; R 1992) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
MSS SP-110	(1992) Ball Valves Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(1996) National Fuel Gas Code
NFPA 70	(1996) National Electrical Code
NFPA 8502	(1995) Prevention of Furnace Explosions/Implosions in Multiple Burner Boiler-Furnaces
NFPA 211	(1996) Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances
NFPA 8501	(1997) Single Burner Boiler Operations

UNDERWRITERS LABORATORIES (UL)

UL-06	(1994; Supple) Gas and Oil Equipment Directory
UL 795	(1994) Commercial-Industrial Gas Heating Equipment
UL 1738	(1993) Venting Systems for Gas-Burning Appliances, Categories II, III and IV

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the

products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

1.2.2 Asbestos Prohibition

Asbestos and asbestos-containing products shall not be used.

1.2.3 Nameplates

Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment. Each pressure vessel shall have an approved ASME stamp.

1.2.4 Equipment Guards

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded in accordance with OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified. Catwalks, operating platforms, ladders, and guardrails shall be provided where shown and shall be constructed in accordance with Section 05500 MISCELLANEOUS METAL.

1.2.5 Verification of Dimensions

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work or ordering any materials.

1.2.6 Welding

Boilers and piping shall be welded and brazed in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section 05055 WELDING, STRUCTURAL.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Catalog Data; GA.

Manufacturer's catalog data shall be included with the detail drawings for the following items:

Boilers
Pumps
Fittings and Accessories

Water Treatment System

The data shall show model, size, options, etc., that are intended for consideration. Data submitted shall be adequate to demonstrate compliance with contract requirements.

Spare Parts Data; GA.

Spare parts data for each different item of material and equipment, after approval of the detail drawings and no later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 and 3 years of service.

Water Treatment Plan; GA.

Six complete copies of the proposed water treatment plan. The plan shall include a layout, control scheme, a list of the existing water conditions including the items listed in paragraph BOILER WATER TREATMENT, a list of all chemicals, the proportion of chemicals to be added, the final treated water conditions, and a description of environmental concerns for handling the chemicals.

Heating and Fuel Systems Test Procedures; GA.

Proposed test procedures for the heating system tests and fuel system tests, at least 2 weeks prior to the start of related testing.

Welding Procedures; FIO.

A copy of qualified welding procedures, at least 2 weeks prior to the start of welding operations.

Qualification; FIO.

A statement from the firms proposed to prepare submittals and perform installation and testing, demonstrating successful completion of similar services of at least five projects of similar size or scope, at least 2 weeks prior to the submittal of any other item required by this section.

Welding Qualification; FIO.

A list of names and identification symbols of qualified welders and welding operators, at least 2 weeks prior to the start of welding operations.

SD-04 Drawings

Heating System; GA.

Detail drawings consisting of equipment layout including installation details and electrical connection diagrams; combustion and safety control diagrams; ductwork layout showing the location of supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of guides and anchors, the load imposed on each support or anchor, and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

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SD-06 Instructions

Posted Instructions; GA.

System layout diagrams that show the layout of equipment, piping, and ductwork and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system, framed under glass or laminated plastic, at least 2 weeks prior to the start of related testing. After approval, these items shall be posted where directed.

SD-07 Schedules

Tests; GA.

Proposed test schedules for the heating system and fuel system tests, at least 2 weeks prior to the start of related testing.

SD-09 Reports

Heating System and Fuel System Tests; GA.

Test reports for the heating system tests and the fuel system test, upon completion of testing complete with results.

Water Treatment Tests; GA.

(1) The water quality test report shall identify the chemical composition of the boiler water. The report shall include a comparison of the condition of the boiler water with the manufacturer's recommended conditions. Any required corrective action shall be documented within the report.

(2) A test report shall identify the condition of the boiler at the completion of 1 year of service. The report shall include a comparison of the condition of the boiler with the manufacturer's recommended operating conditions.

SD-13 Certificates

Bolts; FIO.

Written certification by the bolt manufacturer that the bolts furnished comply with the requirements of this specification. The certification shall include illustrations of product markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

Boiler Emissions; GA.

Written certification by the boiler manufacturer that each boiler furnished complies with Federal, state, and local regulations for emissions. The certification shall also include a description of applicable emission regulations. If any boiler is exempt from the emission regulations, the certification shall indicate the reason for the exemption. Submit construction and operating permits for gas-fired boilers through Ft. Campbell Directorate of Public Works (DPW). POC is Patty Lockard (502-798-9795).

SD-19 Operation and Maintenance Manuals

Heating System; GA.

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Six complete manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, simplified wiring and control diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

Water Treatment System; GA.

Six complete copies of operating and maintenance manuals for the step-by-step water treatment procedures, including procedures for testing the water quality.

1.4 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installing, adjusting, and testing of the equipment.

1.5 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be protected from the weather, humidity and temperature variations, dirt and dust, and other contaminants.

PART 2 PRODUCTS

2.1 BOILERS

Each boiler shall have the output capacity in kilowatts (kW) as indicated when fired with the specified fuels. The boiler shall be furnished complete with the gas burning equipment, boiler fittings and trim, automatic controls,forced draft fan, electrical wiring, insulation, piping connections, and protective jacket. The boiler shall be completely assembled and tested at the manufacturer's plant. Boiler auxiliaries including fans, motors, drives, and similar equipment shall be provided with at least 10 percent excess capacity to allow for field variations in settings and to compensate for any unforeseen increases in pressure losses in appurtenant piping and ductwork. However, the boiler safety devices shall not be sized for a 10 percent excess capacity. The boiler and its accessories shall be designed and installed to permit ready accessibility for operation, maintenance, and service. Boilers shall be designed, constructed, and equipped in accordance with ASME BPV IV. Each boiler shall be of the firetube or firetube condensing type and designed for water service as specified herein. The boiler capacity shall be based on the ratings shown in HYI-IBR Ratings or as certified by the American Boiler Manufacturers Association, or American Gas Association.

2.1.1 Firetube Boiler

Boiler shall be self-contained, multipass, packaged type, complete with all accessories, mounted on a structural steel base. When the boilers is operating at maximum output, the heat input rates shall not be greater than 21 Kw per square meterof fireside heating surface. The volume heat input rate shall not be less than 2,07 Kw per cubic meter of furnace volume.

2.1.2 through 2.1.5 NOT USED

2.1.6 Hot Water Heating Boilers

The hot water heating boiler shall be capable of operating at the specified maximum continuous capacity without

damage or deterioration to the boiler, its setting, firing equipment, or auxiliaries. The rated capacity shall be the capacity at which the boiler will operate continuously while maintaining at least the specified minimum efficiency. The boiler design conditions shall be as follows:

a. Boiler design pressure 1100 kPa.

b. Operating pressure at boiler outlet 200 kPa.

c. Hot water temperature 82 degrees C.

d. Temperature differential between boiler discharge and system return 11 degrees C.

e. Water pressure drop 70 kPa.

f. Outdoor ambient air temperature 35 degrees C(max), -30 degrees C (min).

g. Site elevation 170 m.

2.2 FUEL BURNING EQUIPMENT

Boiler shall be designed to burn gas. Each boiler shall comply with Federal, state, and local emission regulations.

2.2.1 Burners

2.2.1.1 Gas Fired Burners and Controls

Burners shall be UL approved mechanical draft burners with all air necessary for combustion supplied by a blower where the operation is coordinated with the burner. Burner shall be provided complete with fuel supply system in conformance with the following safety codes or standards:

a. Gas-fired units shall conform to UL 795. Gas fired units less than 3.66 MW input shall conform to ANSI Z21.13.

2.2.2 NOT USED

2.2.3 Draft Damper

Boilers shall be provided with manual dampers, draft hoods, or barometric dampers as recommended by the boiler manufacturer to maintain proper draft in the boiler. Draft damper shall be provided in a convenient and accessible location in the flue gas outlet from the boiler. Automatic damper shall be arranged for automatic operation by means of a damper motor.

2.3 COMBUSTION CONTROL EQUIPMENT

Combustion control equipment shall be provided as a system by a single manufacturer. Field installed automatic combustion control system shall be installed in accordance with the manufacturer's recommendations and under the direct supervision of a representative of the control manufacturer. The boiler water temperature shall be controlled by a water temperature controller. The equipment shall operate electrically.

2.3.1 NOT USED

2.3.2 Electrical controls

Electrical control devices shall be rated at 120 volts and shall be connected as specified in Section 16415 ELECTRICAL WORK, INTERIOR.

2.3.3 Water Temperature Controller

The controller shall be of sturdy construction and shall be protected against dust and dampness. The thermostatic element shall be inserted in a separable socket installed in the boiler return piping. Fixed position (on-off) and three position (high-low-off) controller shall operate on a 5.56 degree C (10 degree F) differential over an adjustable temperature range of approximately 60 to 104.4 degrees C (140 to 220 degrees F).

2.3.4 NOT USED

2.3.5 NOT USED

2.3.6 Boiler Combustion Controls and Positioners

a. Gas boiler units shall be provided with fixed rate (on-off) three position (high-low-off) combustion controls with gas pilot or spark ignition. Modulating controls shall be provided with a means for manually controlling the firing rate.

b. Fixed rate on-off or high-low-off controls for boilers with capacities up to 600 kW (2,000,000 Btuh) shall use a water temperature controller in a temperature well in direct contact with the water.

2.3.7 Combustion Safety Controls and Equipment

Combustion safety controls and equipment shall be UL listed, microprocessor-based distributed process controller. The controller shall be composed of an EPROM type chip. The system shall include mounting hardware, wiring and cables, and associated equipment. The controller shall be mounted completely wired, programmed, debugged, and tested to perform all of its functions. The controller shall process the signals for complete control and monitoring of the boiler. This shall include maintaining boiler status, starting and stopping all control functions, sequencing control functions and signaling alarm conditions. The program shall be documented and include cross references in description of coils and contacts. Microprocessor shall be able to perform self diagnostics and contain a message center to provide operator with status and failure mode information. Controllers for each boiler shall be mounted on a separate, free standing panel adjacent to the boiler or for packaged boilers on the boiler supporting structure. Control systems and safety devices for automatically fired boilers shall conform to ASME CSD-1. Electrical combustion and safety controls shall be rated at 120 volts, single phase, 60 Hz and shall be connected as specified in Section 16415 ELECTRICAL WORK, INTERIOR. A 100 mm diameter alarm bell shall be provided and shall be located where indicated or directed. The alarm bell shall ring when the boiler is shut down by any safety control or interlock. Indicating lights shall be provided on the control panel. A red light shall indicate flame failure, and a green light shall indicate that the main fuel valve is open. The following shutdown conditions shall require a manual reset before the boiler can automatically recycle:

a. Flame failure.

b. Failure to establish pilot flame.

c. Failure to establish main flame.

d. Low-water cutoff.

e. High temperature cutoff.

2.3.7.1 Low-water Cutoff

Low-water cutoff shall be provided to stop the burner and draft fan when the water level drops below a predetermined point. The cutoff shall consist of a float chamber with float, float switch, and drain valve. The float switch shall be mounted on the float chamber with a packless-type leakproof connection. The float mechanism and drain valve shall be constructed of a corrosion-resistant material. The low-water cutoff shall be UL-06 listed and shall be furnished with approved fittings and installed according to ASME boiler code requirements. The following type of low-water cutoff shall be utilized.

a. Pump Controller with Low-Water Cutoff: Controller shall be a design approved by the boiler manufacturer. A pump controller shall be provided for each boiler which is used for space heating and process steam loads or long distribution lines. Pump controller shall control the operation of the burner, forced-draft fan, and pump. Pump controller and low-water cutoff shall have a float-operated mercury switch arranged to start and stop the pump at preset boiler water levels. If the water level in the boiler reaches the low danger point, a second mercury switch shall shut down the burner and actuate the alarm bell.

2.3.7.2 Water Flow Interlock

Hot water boiler limit controls shall be provided to include protection for low boiler water flow and high boiler water temperature. The limit controls shall be interlocked with the combustion control system to effect boiler alarm and shutdown. The controls shall not allow boiler startup unless hot water flow is proven.

2.4 PUMPS

2.4.1 NOT USED

2.4.2 Hot Water and Boiler Circulating Pumps

Circulating pumps for hot water shall be electrically driven single-stage centrifugal type and have a capacity not less than indicated. Boiler circulating pumps shall be supported on a concrete foundation with a cast iron or structural steel base or by the piping on which installed and shall be closed-coupled shaft . The boiler circulating pumps shall be horizontal split case or vertical split case type. Hot water circulating pumps shall be supported on a concrete foundation with a cast iron or structural steel base or by the piping on which installed and shall have a closed-coupled shaft or flexible-coupled shaft. The hot water circulating pumps shall be horizontal split case type. The pump shaft shall be constructed of corrosion-resistant alloy steel, sleeve bearings and glands of bronze designed to accommodate a mechanical seal, and the housing of close-grained cast iron. Pump seals shall be capable of withstanding 115 degrees C temperature without external cooling. The motor shall have sufficient power for the service required, shall be of a type approved by the manufacturer of the pump, shall be suitable for the available electric service, and shall conform to the requirements of paragraph ELECTRICAL EQUIPMENT. Each pump suction and discharge connection shall be provided with a pressure gauge as specified. The boiler circulating pump discharge header shall be provided with a flow switch . Flow switch unit shall be a self-contained swinging vane type to indicate fluid flow. Switch shall be a SPDT with 120-volt, 15-ampere rating.

2.5 UNIT HEATERS

Unit heaters shall be in accordance with Section 15556, FORCED HOT WATER HEATING SYSTEMS.

2.6 HEATING AND VENTILATING UNITS

Heating and ventilating units and associated equipment shall be in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

2.7 AIR HANDLING UNITS

Air handling units and associated equipment shall be in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

2.8 FITTINGS AND ACCESSORIES

Boiler fittings and accessories shall be installed with each boiler in accordance with ASME BPV IV, unless otherwise specified.

2.8.1 through 2.8.3 NOT USED

2.8.4 Conventional Breeching and Stacks

2.8.4.1 Breeching

Each boiler shall be connected to the stack or flue by breeching constructed of black steel sheets not less than 1.2 mm (0.0478 inch) thick nor less than thickness of stack, whichever is larger. The clear distance between any portion of the breeching surface and any combustible material shall not be less than that specified in NFPA 211. Joints and seams shall be securely fastened and made airtight. Suitable hinged and gasketed cleanouts shall be provided, which will permit cleaning the entire smoke connection without dismantling. Flexible-type expansion joints shall be provided as required and shall not require packing.

2.8.4.2 Stacks

Prefabricated double wall stacks system shall extend above the roof to the height indicated. The inner stack shall be 304 stainless steel having a thickness of not less than 0.89 mm (0.035 inch). The outer stack shall be sheet steel having a thickness of not less than 0.635 mm (0.025 inch). A method of maintaining concentricity between the inner and outer stacks shall be incorporated. The joints between the stack sections shall be sealed to prevent flue gas leakage. A 7.92 mm diameter hole shall be provided in the stack not greater than 150 mm from the furnace flue outlet for sampling of the exit gases. A method shall be provided to seal the hole to prevent exhaust gases from entering the boiler room when samples are not being taken. Each stack shall be provided complete with rain hood.

2.8.5 NOT USED

2.8.6 Expansion Tank

The hot water pressurization system shall include a diaphragm-type expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting the pressure increase at all components in the system to the maximum allowable pressure at those components. The only air in the system shall be the permanent sealed-in air cushion contained in the diaphragm-type tank. The sizes shall be as indicated. The expansion tank shall be welded steel, constructed, tested, and stamped in accordance with ASME BPV VIII Div 1 for a working pressure of 850 kPa (125 psi) and precharged to the minimum operating pressure. The tank's air chamber shall be fitted with an air charging valve and pressure gauge. The tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations. The tank shall have lifting rings and a drain connection. All components shall be suitable for a maximum operating temperature of 120 degrees C (250 degrees F).

2.8.7 Air Separator

External air separation tank shall be steel, constructed, tested and stamped in accordance with ASME BPV VIII Div 1 for a working pressure of 850 kPa (125 psi). The capacity of the air separation tank indicated is minimum.

2.8.8 through 2.8.11 NOT USED

2.8.12 Steel Pipe and Fittings

2.8.12.1 Steel Pipe

Steel pipe shall be ASTM A 53, Type E or S, Grade A or B, black steel, standard weight.

2.8.12.2 Steel Pipe Fittings

Fittings shall have the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

2.8.12.3 Steel Flanges

Flanged fittings including flanges, bolts, nuts, bolt patterns, etc. shall be in accordance with ASME B16.5 class 150 and shall have the manufacturers trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105. Flanges for high temperature water systems shall be serrated or raised-face type. Blind flange material shall conform to ASTM A 516 cold service and ASTM A 515 for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193.

2.8.12.4 Welded Fittings

Welded fittings shall conform to ASTM A 234 with WPA marking. Buttwelded fittings shall conform to ASME B16.9, and socket-welded fittings shall conform to ASME B16.11.

2.8.12.5 Cast-Iron Fittings

Fittings shall be ASME B16.4, Class 125, type required to match connecting piping.

2.8.12.6 Malleable-Iron Fittings

Fittings shall be ASME B16.3, type as required to match connecting piping.

2.8.12.7 Unions

Unions shall be ASME B16.39, Class 150.

2.8.12.8 Threads

Pipe threads shall conform to ASME B1.20.1.

2.8.12.9 Grooved Mechanical fittings

Joints and fittings shall be designed for not less than 862 kPa (125 psig) service and shall be the product of the same

manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12; or steel conforming to ASTM A 106, Grade B or ASTM A 53. Gaskets shall be molded synthetic rubber with central cavity, pressure responsive configuration and shall conform to ASTM D 2000, Grade No. 2CA615A15B44F17Z for circulating medium up to 110 degrees C (230 degrees F) or Grade N0. M3BA610A15B44Z for circulating medium up to 93 degrees C (200 degrees F). Grooved joints shall conform to AWWA C606. Coupling nuts and bolts shall be steel and shall conform to ASTM A 183.

2.8.13 Copper Tubing and Fittings

2.8.13.1 Copper Tubing

Tubing shall be ASTM B 88, Type K or L. Adapters for copper tubing shall be brass or bronze for brazed fittings.

2.8.13.2 Solder-Joint Pressure Fittings

Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B 75. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18 and ASTM B 828.

2.8.13.3 Flared Fittings

Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62.

2.8.13.4 Adapters

Adapters may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used.

2.8.13.5 Threaded Fittings

Cast bronze threaded fittings shall conform to ASME B16.15.

2.8.13.6 Brazing Material

Brazing material shall conform to AWS A5.8.

2.8.13.7 Brazing Flux

Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides, and contain fluorides. Silver brazing materials shall be in accordance with AWS A5.8.

2.8.13.8 Solder Material

Solder metal shall conform to ASTM B 32 95-5 tin-antimony.

2.8.13.9 Solder Flux

Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.

2.8.14 Dielectric Unions

Dielectric unions shall have metal connections on both ends. The ends shall be threaded, flanged, or brazed to match adjacent piping. Metal parts of the union shall be separated so that the electrical current is below 1 percent of the galvanic current which would exist upon metal-to-metal contact.

2.8.15 Flexible Pipe Connectors

Flexible pipe connectors shall be designed for 861.8 kPa (125 psi) or 1034.2 kPa (150 psi) service. Connectors shall be installed where indicated. The flexible section shall be constructed of rubber, tetrafluoroethylene resin, or corrosion-resisting steel, bronze, monel, or galvanized steel. Materials used and the configuration shall be suitable for the pressure, vacuum, and temperature medium. The flexible section shall be suitable for service intended and may have threaded, welded, soldered, flanged, or socket ends. Flanged assemblies shall be equipped with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Covers to protect the bellows shall be provided where indicated.

2.8.16 Pipe Supports

Pipe supports shall conform to MSS SP-58 and MSS SP-69.

2.8.17 Pipe Expansion

2.8.17.1 Expansion Loops

Expansion loops and offsets shall provide adequate expansion of the main straight runs of the system within the stress limits specified in ASME B31.1. The loops and offsets shall be cold-sprung and installed where indicated. Pipe guides and anchors shall be provided as indicated.

2.8.17.2 Expansion Joints

Expansion joints shall provide for either single or double slip of the connected pipes, as required or indicated, and for not less than the transverse indicated. The joints shall be designed for a hot water working pressure not less than 862 kPa (125 psig) and shall be in accordance with applicable requirements of EJMA-01 and ASME B31.1. End connection shall be flanged. Anchor bases or support bases shall be provided as indicated or required. Sliding surfaces and water wetted surfaces shall be chromium plated or fabricated of corrosion resistant steel. Initial setting shall be made in accordance with the manufacturer's recommendations to compensate for an ambient temperature at time of installation. Pipe alignment guides shall be installed as recommended by the joint manufacturer, but in any case shall not be more than 1.5 m from expansion joint, except in lines 100 mm (4 inches) or smaller guides shall be installed not more than 600 mm from the joint. Service outlets shall be provided where indicated.

a. Bellows-type joints shall be flexible, guided expansion joints. The expansion element shall be stabilized corrosion resistant steel. Bellows-type expansion joints shall conform to the applicable requirements of EJMA-01 and ASME B31.1 with internal lines. Guiding of piping on both sides of expansion joint shall be in accordance with the published recommendations of the manufacturer of the expansion joint. The joints shall be designed for the working temperature and pressure suitable for the application but shall not be less than 1135 kPa.

b. Flexible ball joints shall be constructed of alloys as appropriate for the service intended. The joints shall be threaded, grooved, flanged, or welded end as required and shall be capable of absorbing the normal operating axial, lateral, or angular movements or combination thereof. Balls and sockets shall be polished, chromium-plated when materials are not of corrosion-resistant steel. The ball type joint shall be designed and constructed in accordance with

ASME B31.1 and EJMA-01. Flanges shall conform to the diameter and drilling of ASME B16.5. Molded gaskets shall be suitable for the service intended.

c. Slip type expansion joints shall be EJMA-01 and ASME B31.1, class 1 or 2. Type II joints shall be suitable for repacking under full line pressure.

2.8.18 Valves

Valves shall be Class 125 and shall be suitable for the application. Grooved ends per AWWA C606 may be used for water service only. Valves in nonboiler external piping shall meet the material, fabrication and operating requirements of ASME B31.1. The connection type of all valves shall match the same type of connection required for the piping on which installed.

2.8.18.1 Gate Valves

Gate valves 65 mm (2-1/2 inches) and smaller shall conform to MSS SP-80 bronze rising stem, threaded, solder, or flanged ends. Gate valves 80 mm (3 inches) and larger shall conform to MSS SP-70 cast iron bronze trim, outside screw and yoke, flanged, or threaded ends.

2.8.18.2 Globe Valves

Globe valves 65 mm (2-1/2 inches) and smaller shall conform to MSS SP-80, bronze, threaded, soldered, or flanged ends. Globe valves 80 mm (3 inches) and larger shall conform to MSS SP-85, cast iron, bronze trim, flanged, or threaded ends.

2.8.18.3 Check Valves

Check valves 65 mm (2-1/2 inches) and smaller shall conform to MSS SP-80, bronze, threaded, soldered, or flanged ends. Check valves 80 mm (3 inches) and larger shall conform to MSS SP-71, cast iron, bronze trim, flanged, or threaded ends.

2.8.18.4 Angle Valves

Angle valves 65 mm (2-1/2 inches) and smaller shall conform to MSS SP-80 bronze, threaded, soldered, or flanged ends. Angle valves 80 mm (3 inches) and larger shall conform to MSS SP-85, cast iron, bronze trim, flanged, or threaded ends.

2.8.18.5 Ball Valves

Ball valves 15 mm (1/2 inch) and larger shall conform to MSS SP-72 or MSS SP-110, ductile iron or bronze, threaded, soldered, or flanged ends.

2.8.18.6 Plug Valves

Plug valves 51 mm and larger shall conform to MSS SP-78. Plug valves smaller than 51 mm shall conform to ASME B16.34.

2.8.18.7 Grooved End Valves

Valves with grooved ends per AWWA C606 may be used if the valve manufacturer certifies that their performance

meets the requirements of the standards indicated for each type of valve.

2.8.18.8 Balancing Valves

Balancing valves shall have meter connections with positive shutoff valves. An integral pointer shall register the degree of valve opening. Valves shall be calibrated so that flow rate can be determined when valve opening in degrees and pressure differential across valve is known. Each balancing valve shall be constructed with internal seals to prevent leakage and shall be supplied with preformed insulation. Valves shall be suitable for 120 degrees C (250 degrees F) temperature and working pressure of the pipe in which installed. Valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable meter to measure the pressure differential. One portable differential meter shall be furnished. The meter suitable for the operating pressure specified shall be complete with hoses, vent, and shutoff valves, and carrying case. In lieu of the balancing valve with integral metering connections, a ball valve or plug valve with a separately installed orifice plate or venturi tube may be used for balancing.

2.8.18.9 NOT USED

2.8.18.10 NOT USED

2.8.18.11 Drain valves

Drain valves shall be provided at each drain point of blowdown as recommended by the boiler manufacturer. Piping shall conform to ASME BPV IV and ASTM A 53.

2.8.18.12 Safety Valves

Safety valves shall have steel bodies and shall be equipped with corrosion-resistant trim and valve seats. The valves shall be properly guided and shall be positive closing so that no leakage can occur. Adjustment of the desired back-pressure shall cover the range between 15 and 70 kPa (2 and 10 psig). The adjustment shall be made externally, and any shafts extending through the valve body shall be provided with adjustable stuffing boxes having renewable packing. Boiler safety valves of proper size and of the required number, in accordance with ASME BPV IV, shall be installed so that the discharge will be through piping extended to a location as indicated. Each discharge pipe for hot water service shall be pitched away from the valve seat.

2.8.19 Strainers

Basket and "Y" type strainers shall be the same size as the pipelines in which they are installed. The strainer bodies shall be heavy and durable, fabricated of cast iron, and shall have bottoms drilled and tapped with a gate valve attached for blowdown purposes. Strainers shall be designed for 1035 kPa (150 psig) service and 115 degrees C (240 degrees F). The bodies shall have arrows clearly cast on the sides indicating the direction of flow. Each strainer shall be equipped with an easily removable cover and sediment screen. The screen shall be made of 0.795 mm thick brass sheet, monel, or corrosion-resistant steel with small perforations numbering not less than 620,000 per square mto provide a net free area through the basket of at least 3.30 times that of the entering pipe. The flow shall be into the screen and out through the perforations.

2.8.20 Pressure Gauges

Gauges shall conform to ASME B40.1 and shall be provided with throttling type needle valve or a pulsation dampener and shutoff valve. Minimum dial size shall be 90 mm (3-1/2 inches). A pressure gauge shall be provided for each boiler in a visible location on the boiler.

2.8.21 Thermometers

Thermometers shall be provided with wells and separable corrosion-resistant steel sockets. Thermometers for inlet water and outlet water for each hot water boiler shall be provided in a visible location on the boiler. Thermometers shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a minimum 225 mm (9 inch) scale.

2.8.22 Air Vents

2.8.22.1 Manual Air Vents

Manual air vents shall be brass or bronze valves or cocks suitable for the pressure rating of the piping system and furnished with threaded plugs or caps.

2.8.22.2 Automatic Air Vents

Automatic air vents shall be 20 mm (3/4 inch) quick-venting float and vacuum air valves. Each air vent valve shall have a large port permitting the expulsion of the air without developing excessive back pressure, a noncollapsible metal float which will close the valve and prevent the loss of water from the system, an air seal that will effectively close and prevent the re-entry of air into the system when subatmospheric pressures prevail therein, and a thermostatic member that will close the port against the passage of steam from the system. The name of the manufacturer shall be clearly stamped on the outside of each valve. The air vent valve shall be suitable for the pressure rating of the piping system.

2.9 ELECTRICAL EQUIPMENT

Electric motor-driven equipment shall be provided complete with motors, motor starters, and necessary control devices. Electrical equipment, motor control devices, motor efficiencies and wiring shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR. Motors which are not an integral part of a packaged boiler shall be rated for standard efficiency service. Motors which are an integral part of the packaged boiler shall be the highest efficiency available by the manufacturer of the packaged boiler. Motor starters shall be provided complete with properly sized thermal overload protections and other appurtenances necessary for the motor control specified. Starters shall be furnished in general purpose enclosures. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices but not shown shall be provided.

2.9.1 Motor Ratings

Motors shall be suitable for the voltage and frequency provided. Motors 375 W (1/2 hp) and larger shall be three-phase, unless otherwise indicated. Motors shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating on the motor.

2.9.2 Motor Controls

Motor controllers shall be provided complete with properly sized thermal overload protection. Manual or automatic control and protective or signal devices required for the operation specified and any wiring required to such devices shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers may be provided to accomplish the same function. Solid state variable speed controllers shall be utilized for fractional through 7.46 kW (10 hp) ratings. Adjustable frequency drives shall be used for larger motors.

2.10 INSULATION

Shop and field-applied insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.11 TOOLS

Special tools shall be furnished. Special tools shall include uncommon tools necessary for the operation and maintenance of boilers, burners, pumps, fans, controls, meters, special piping systems, and other equipment. Small hand tools shall be furnished within a suitable cabinet, mounted where directed.

2.11.1 through 2.11.3 NOT USED

2.11.4 Wrenches

Wrenches shall be provided as required for specialty fittings such as manholes, handholes, and cleanouts. One set of extra gaskets shall be provided for all manholes and handholes, for pump barrels, and other similar items of equipment. Gaskets shall be packaged and properly identified.

2.12 NOT USED

2.13 BOILER WATER TREATMENT

The water treatment system shall be capable of feeding chemicals and bleeding the system to prevent corrosion and scale within the boiler and piping distribution system. The water shall be treated to maintain the conditions recommended by the boiler manufacturer. Chemicals shall meet required federal, state, and local environmental regulations for the treatment of boilers and discharge to the sanitary sewer. The services of a company regularly engaged in the treatment of boilers shall be used to determine the correct chemicals and concentrations required for water treatment. The company shall maintain the chemical treatment and provide all chemicals required for a period of 1 year from the date of occupancy. Filming amines and proprietary chemicals shall not be used. The water treatment chemicals shall remain stable throughout the operating temperature range of the system and shall be compatible with pump seals and other elements of the system.

2.13.1 thru 2.13.9 NOT USED

2.13.10 Chemical Shot Feeder

A shot feeder shall be provided as indicated. Size and capacity of feeder shall be based upon local requirements and water analysis. The feeder shall be furnished with an air vent, gauge glass, funnel, valves, fittings, and piping.

2.13.11 Chemical Piping

The piping and fittings shall be constructed of steel or stainless steel.

2.13.12 Test Kits

One test kit of each type required to determine the water quality as outlined within the operation and maintenance manuals shall be provided.

PART 3 EXECUTION

3.1 ERECTION OF BOILER AND AUXILIARY EQUIPMENT

SAFETY PAYS

Boiler and auxiliary equipment shall be installed in accordance with manufacturer's written instructions.

3.2 PIPING INSTALLATION

Unless otherwise specified, nonboiler external pipe and fittings shall conform to the requirements of ASME B31.1. Pipe installed shall be cut accurately to suit field conditions, shall be installed without springing or forcing, and shall properly clear windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted. Pipes shall be free of burrs, oil, grease and other foreign material and shall be installed to permit free expansion and contraction without damaging the building structure, pipe, pipe joints, or pipe supports. Changes in direction shall be made with fittings, except that bending of pipe 100 mm (4 inches) and smaller will be permitted provided a pipe bender is used and wide sweep bends are formed. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted. Vent pipes shall be carried through the roof as directed and shall be properly flashed. Unless otherwise indicated, horizontal supply mains shall pitch down in the direction of flow with a grade of not less than 0.2 percent. Open ends of pipelines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign materials out of the systems. Pipe not otherwise specified shall be uncoated. Unless otherwise specified or shown, final connections to equipment shall be made with malleable-iron unions for steel pipe 65 mm (2-1/2 inches) or less in diameter and with flanges for pipe 80 mm (3 inches) or more in diameter. Unions for copper pipe or tubing shall be brass or bronze. Reducing fittings shall be used for changes in pipe sizes. In horizontal hot water lines, reducing fittings shall be eccentric type to maintain the top of the lines at the same level to prevent air binding.

3.2.1 Cold Water Connections

Cold water fill connections shall be made to the water supply system as indicated. Necessary pipe, fittings, and valves required for water connections between the boiler and cold water main shall be provided as shown. The pressure regulating valve shall be of a type that will not stick or allow pressure to build up on the low side. The valve shall be set to maintain a terminal pressure of approximately 35 kPa in excess of the static head on the system and shall operate within a 15 kPa tolerance regardless of cold water supply piping pressure and without objectionable noise under any condition of operation.

3.2.2 Hot Water Piping and Fittings

Pipe shall be black steel or copper tubing. Fittings for steel piping shall be black malleable iron or cast iron to suit piping. Fittings adjacent to valves shall suit valve material. Grooved mechanical fittings will not be allowed for water temperatures above 110 degrees C (230 degrees F).

3.2.3 Vent Piping and Fittings

Vent piping shall be black steel. Fittings shall be black malleable iron or cast iron to suit piping.

3.2.4 Gauge Piping

Piping shall be copper tubing.

3.2.5 NOT USED

3.2.6 NOT USED

3.2.7 Joints

Joints between sections of steel pipe and between steel pipe and fittings shall be threaded, grooved, flanged or welded as indicated or specified. Except as otherwise specified, fittings 25 mm (1 inch) and smaller shall be threaded; fittings 32 mm (1-1/4 inches)and up to but not including 80 mm (3 inches) shall be either threaded, grooved, or welded; and fittings 80 mm (3 inches) and larger shall be either flanged, grooved, or welded. Pipe and fittings 32 mm (1-1/4 inches) and larger installed in inaccessible conduit or trenches beneath concrete floor slabs shall be welded. Connections to equipment shall be made with black malleable-iron unions for pipe 65 mm (2-1/2 inches) or smaller in diameter and with flanges for pipe 80 mm (3 inches) inches or larger in diameter. Joints between sections of copper tubing or pipe shall be flared, soldered, or brazed.

3.2.7.1 Threaded Joints

Threaded joints shall be made with tapered threads properly cut and shall be made perfectly tight with a stiff mixture of graphite and oil or with polytetrafluoroethylene tape applied to the male threads only and in no case to the fittings.

3.2.7.2 Welded Joints

Welded joints shall be in accordance with paragraph GENERAL REQUIREMENTS unless otherwise specified. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connections may be made with either welding tees or forged branch outlet fittings, either being acceptable without size limitation. Branch outlet fittings, where used, shall be forged, flared for improved flow characteristics where attached to the run, reinforced against external strains, and designed to withstand full pipe bursting strength. Socket weld joints shall be assembled so that the space between the end of the pipe and the bottom of the socket is no less than 1.5 mm and no more than 3 mm.

3.2.7.3 Grooved Mechanical Joints

Grooved mechanical joints may be provided for hot water systems in lieu of unions, welded, flanged, or screwed piping connections in low temperature hot water systems where the temperature of the circulating medium does not exceed 110 degrees C. Grooves shall be prepared according to the coupling manufacturer's instructions. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, or narrow-land micrometer. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations. Mechanical joints shall use rigid mechanical pipe couplings, except at equipment connections. At equipment connections, flexible couplings may be used. Coupling shall be of the bolted type for use with grooved end pipes, fittings, valves, and strainers. Couplings shall be self-centering and shall engage in a watertight couple.

3.2.7.4 Flared and Brazed Copper Pipe and Tubing

Tubing shall be cut square, and burrs shall be removed. Both inside of fittings and outside of tubing shall be cleaned thoroughly with sand cloth or steel wire brush before brazing. Annealing of fittings and hard-drawn tubing shall not occur when making connections. Installation shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA 404/0-RR with flux. Copper-to-copper joints shall include the use of copper-phosphorous or copper-phosphorous-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorous, copper-phosphorous-silver or a silver brazing filler metal. Joints for flared fittings shall be of the compression pattern. Swing joints or offsets shall be provided in all branch connections, mains, and risers to provide for expansion and contraction forces without undue stress to the fittings or to short lengths of pipe or tubing. Flared or brazed copper tubing to pipe adapters shall be provided where necessary for joining threaded pipe to copper tubing.

3.2.7.5 Soldered Joints

Soldered joints shall be made with flux and are only acceptable for lines 50 mm (2 inches) and smaller. Soldered joints shall conform to ASME B31.5 and CDA 404/0-RR.

3.2.7.6 Copper Tube Extracted Joint

An extruded mechanical tee joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. The branch tube shall be notched for proper penetration into fitting to assure a free flow joint. Extracted joints shall be brazed using a copper phosphorous classification brazing filler metal. Soldered joints will not be permitted.

3.2.8 Flanges and Unions

Flanges shall be faced true, provided with 1.6 mm (1/16 inch) thick gaskets, and made square and tight. Where steel flanges mate with cast-iron flanged fittings, valves, or equipment, they shall be provided with flat faces and full face gaskets. Union or flange joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items. Dielectric pipe unions shall be provided between ferrous and nonferrous piping to prevent galvanic corrosion. The dielectric unions shall have metal connections on both ends. The ends shall be threaded, flanged, or brazed to match adjacent piping. The metal parts of the union shall be separated so that the electrical current is below 1 percent of the galvanic current which would exist upon metal-to-metal contact. Gaskets, flanges, and unions shall be installed in accordance with manufacturer's recommendations.

3.2.9 Branch Connections

3.2.9.1 Branch Connections for Hot Water Systems

Branches from the main shall pitch up or down as shown to prevent air entrapment. Connections shall ensure unrestricted circulation, eliminate air pockets, and permit complete drainage of the system. Branches shall pitch with a grade of not less than 8 mm in 1 m. When indicated, special flow fittings shall be installed on the mains to bypass portions of the water through each radiator. Special flow fittings shall be standard catalog products and shall be installed as recommended by the manufacturer.

3.2.10 through 3.2.12 NOT USED

3.2.13 Flared, Brazed, and Soldered Copper Pipe and Tubing

Copper tubing shall be flared, brazed, or soldered. Tubing shall be cut square, and burrs shall be removed. Both inside of fittings and outside of tubing shall be cleaned thoroughly with sand cloth or steel wire brush before brazing. Annealing of fittings and hard-drawn tubing shall not occur when making connections. Installation shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints for flared fittings shall be of the compression pattern. Swing joints or offsets shall be provided on branch connections, mains, and risers to provide for expansion and contraction forces without undue stress to the fittings or to short lengths of pipe or tubing. Pipe adapters shall be provided where necessary for joining threaded pipe to copper tubing. Brazed joints shall be made in conformance with MSS SP-73, and CDA 404/0-RR. Copper-to-copper joints shall include the use of copper-phosphorous or copper-phosphorous-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-

phosphorous, copper-phosphorous-silver, or a silver brazing filler metal. Soldered joints shall be made with flux and are only acceptable for lines 50 mm (2 inches) or smaller. Soldered joints shall conform to ASME B31.5 and shall be in accordance with CDA 404/0-RR.

3.2.14 Copper Tube Extracted Joint

An extracted mechanical tee joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. The branch tube shall be notched for proper penetration into fitting to assure a free flow joint. Extracted joints shall be brazed using a copper phosphorous classification brazing filler metal. Soldered joints will not be permitted.

3.2.15 Supports

3.2.15.1 General

Hangers used to support piping 50 mm (2 inches) and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers.

3.2.15.2 Seismic Requirements for Supports and Structural Bracing

Piping and attached valves shall be supported and braced to resist seismic loads as specified in Section 13080 SEISMIC PROTECTION FOR MECHANICAL, ELECTRICAL EQUIPMENT. Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided in this section. Material used for supports shall be as specified in Section 05120 STRUCTURAL STEEL.

3.2.15.3 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe which has a vapor barrier. Type 3 may be used on insulated pipe that does not have a vapor barrier if clamped directly to the pipe, if the clamp bottom does not extend through the insulation, and if the top clamp attachment does not contact the insulation during pipe movement.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for Type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices furnished by the manufacturer. Field fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 300 mm from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1500 mm apart at valves.

h. Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 4500 mm, not more than 2400 mm from end of risers, and at vent terminations.

i. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

(1) Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On piping 100 mm (4 inches) and larger, a Type 39 saddle may be welded to the pipe and freely rested on a steel plate. On piping under 100 mm (4 inches), a Type 40 protection shield may be attached to the pipe or insulation and freely rested on a steel slide plate.

(2) Where there are high system temperatures and welding to piping is not desirable, the Type 35 guide shall include a pipe cradle welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 100 mm or by an amount adequate for the insulation, whichever is greater.

j. Except for Type 3, pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation.

k. Piping in trenches shall be supported as indicated.

l. Structural steel attachments and brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material and installation shall be as specified under Section 05120 STRUCTURAL STEEL. Pipe hanger loads suspended from steel joist between panel points shall not exceed 22 kg. Loads exceeding 22 kg shall be suspended from panel points.

3.2.15.4 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support member shall not exceed the hanger and support spacing required for any individual pipe in the multiple pipe run. The clips or clamps shall be rigidly attached to the common base member. A clearance of 3 mm shall be provided between the pipe insulation and the clip or clamp for piping which may be subjected to thermal expansion.

3.2.16 Anchors

Anchors shall be provided where necessary to localize expansion or to prevent undue strain on piping. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results, using turnbuckles where required. Supports, anchors, or stays shall not be attached where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline.

3.2.17 Valves

Valves shall be installed where indicated, specified, and required for functioning and servicing of the systems. Valves shall be safely accessible. Swing check valves shall be installed upright in horizontal lines and in vertical lines only

when flow is in the upward direction. Gate and globe valves shall be installed with stems horizontal or above. Valves to be brazed shall be disassembled prior to brazing and all packing removed. After brazing, the valves shall be allowed to cool before reassembling.

3.2.18 Pipe Sleeves

Pipe passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. A waterproofing clamping flange shall be installed as indicated where membranes are involved. Sleeves shall not be installed in structural members except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor, or roof. Sleeves through walls shall be cut flush with wall surface. Sleeves through floors shall extend above top surface of floor a sufficient distance to allow proper flashing or finishing. Sleeves through roofs shall extend above the top surface of roof at least 150 mm for proper flashing or finishing. Unless otherwise indicated, sleeves shall be sized to provide a minimum clearance of 6 mm between bare pipe and sleeves or between jacket over insulation and sleeves. Sleeves in waterproofing membrane floors, bearing walls, and wet areas shall be galvanized steel pipe or cast-iron pipe. Sleeves in nonbearing walls, floors, or ceilings may be galvanized steel pipe, cast-iron pipe, or galvanized sheet metal with lock-type longitudinal seam. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over insulation and sleeve in nonfire rated walls shall be sealed as indicated and specified in Section 07920 JOINT SEALING. Metal jackets shall be provided over insulation passing through exterior walls, firewalls, fire partitions, floors, or roofs.

Metal jackets shall not be thinner than 0.1524 mm (0.006 inch) thick aluminum, if corrugated, and 0.4 mm (0.016 inch) thick aluminum, if smooth.

Metal jackets shall be secured with aluminum or stainless steel bands not less than 9 mm wide and not more than 200 mm apart. When penetrating roofs and before fitting the metal jacket into place, a 15 mm wide strip of sealant shall be run vertically along the inside of the longitudinal joint of the metal jacket from a point below the backup material to a minimum height of 1000 mm above the roof. If the pipe turns from vertical to horizontal, the sealant strip shall be run to a point just beyond the first elbow. When penetrating waterproofing membrane for floors, the metal jacket shall extend from a point below the back-up material to a minimum distance of 50 mm above the flashing. For other areas, the metal jacket shall extend from a point below the backup material to a point 300 mm above material to a minimum distance of 50 mm above the flashing. For other areas, the metal jacket shall extend from a point below the backup material to a point 300 mm above the floor; when passing through walls above grade, the jacket shall extend at least 100 mm beyond each side of the wall.

3.2.18.1 Pipes Passing Through Roof Waterproofing Membranes

For STANDING SEAM Metal Roof: Pipes passing through roof shall be installed through a preformed neoprene sleeve with hose clamp. The boot shall extend not less than 200 mm from the pipe. The neoprene sleeve shall extend up the pipe a minimum of 250 mm.

For MODIFIED BITUMEN Roof: Pipes passing through waterproofing membranes shall be provided with a 1.6 mm (4 pound)lead flashing or a 0.55 mm (16 ounce)copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 200 mm from the pipe and shall set over the membrane in a troweled coating of bituminous cement. The flashing shall extend above the roof or floor a minimum of 250 mm. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Pipes up to and including 250 mm (10 inches) in diameter which pass through waterproofing membrane may be installed through a sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.

3.2.18.2 Optional Modular Mechanical Sealing Assembly

At the option of the Contractor, a modular mechanical type sealing assembly may be installed in the annular space between the sleeve and conduit or pipe in lieu of a waterproofing clamping flange and caulking and sealing specified above. The seals shall include interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion-protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved.

3.2.18.3 Optional Counterflashing

As alternates to caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may consist of standard roof coupling for threaded pipe up to 150 mm (6 inches) in diameter, lead flashing sleeve for dry vents with the sleeve turned down into the pipe to form a waterproof joint, or a tack-welded or banded-metal rain shield around the pipe, sealed as indicated.

3.2.18.4 Fire Seal

Where pipes pass through firewalls, fire partitions, or floors, a fire seal shall be provided as specified in Section 07270 FIRESTOPPING.

3.2.19 Balancing Valves

Balancing valves shall be installed as indicated.

3.2.20 Thermometer Wells

A thermometer well shall be provided in each return line for each circuit in multicircuit systems.

3.2.21 Air Vents

Air vents shall be installed where shown or directed. Air vents shall be installed in piping at all system high points. The vent shall remain open until water rises in the tank or pipe to a predetermined level at which time it shall close tight. An overflow pipe from the vent shall be run to a point designated by the Contracting Officer's representative. The inlet to the air vent shall have a gate valve or ball valve.

3.2.22 Escutcheons

Escutcheons shall be provided at all finished surfaces where exposed piping, bare or insulated, passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be chromium-plated iron or chromium-plated brass, either one-piece or split pattern, held in place by internal spring tension or setscrews.

3.2.23 Drains

A drain connection with a 25 mm (1 inch) gate valve or 20 mm (3/4 inch) hose bib shall be installed at the lowest point in the return main near the boiler. In addition, threaded drain connections with threaded cap or plug shall be installed on the heat exchanger coil on each unit heater or unit ventilator and wherever required for thorough draining of the system.

3.2.24 Strainer Blow-Down Piping

Strainer blow-down connections shall be fitted with a black steel blow-down pipeline routed to an accessible location and provided with a blow-down valve.

3.2.25 Access Panels

Access panels shall be provided for all concealed valves, vents, controls, and
items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METALS.

3.3 GAS FUEL SYSTEM

Gas piping, fittings, valves, regulators, tests, cleaning, and adjustments shall be in accordance with the Section 15488 GAS PIPING SYSTEMS. NFPA 54 shall be complied with unless otherwise specified. Burners, pilots, and all accessories shall be listed in UL-06. The fuel system shall be provided with a gas tight, manually operated, UL listed stop valve at the gas-supply connections, a gas strainer, a pressure regulator, pressure gauges, a burner-control valve, a safety shutoff valve suitable for size of burner and sequence of operation, and other components required for safe, efficient, and reliable operation as specified. Approved permanent and ready facilities to permit periodic valve leakage tests on the safety shutoff valve or valves shall be provided.

3.4 NOT USED

3.5 FIELD PAINTING

Ferrous metal not specified to be coated at the factory shall be cleaned, prepared, and painted as specified in Section 09900 PAINTING, GENERAL. Exposed pipe covering shall be painted as specified in Section 09900 PAINTING, GENERAL. Aluminum sheath over insulation shall not be painted.

3.6 HEATING SYSTEM TESTS

Before any covering is installed on pipe or heating equipment, the entire heating system's piping, fittings, and terminal heating units shall be hydrostatically tested and proved tight at a pressure of 1-1/2 times the design working pressure. Before pressurizing system for test, items or equipment (e.g., vessels, pumps, instruments, controls, relief valves) rated for pressures below the test pressure shall be blanked off or replaced with spool pieces. Before balancing and final operating test, test blanks and spool pieces shall be removed; and protected instruments and equipment shall be reconnected. With equipment items protected, the system shall be pressurized to test pressure. Pressure shall be held for a period of time sufficient to inspect all welds, joints, and connections for leaks, but not less than 2 hours. No loss of pressure will be allowed. Leaks shall be repaired and repaired joints shall be retested. Caulking of joints shall not be permitted. System shall be drained and after instruments and equipment are reconnected, the system shall be refilled with service medium and maximum operating pressure applied. The pressure shall be held while inspecting these joints and connections for leaks. The leaks shall be repaired and the repaired joints retested. Upon completion of hydrostatic tests and before acceptance of the installation, the Contractor shall balance the heating system in accordance with Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS; and operating tests required to demonstrate satisfactory functional and operational efficiency shall be performed. The operating test shall cover a period of at least 24 hours for each system, and shall include, as a minimum, the following specific information in a report, together with conclusions as to the adequacy of the system:

a. Certification of balancing.

b. Time, date, and duration of test.

c. Outside and inside dry bulb temperatures.

d. Temperature of hot water supply leaving boiler.

e. Temperature of heating return water from system at boiler inlet.

f. Quantity of water feed to boiler.

g. Boiler make, type, serial number, design pressure, and rated capacity.

h. Fuel burner make, model, and rated capacity; ammeter and voltmeter readings for burner motor.

i. Circulating pump make, model, and rated capacity, and ammeter and voltmeter readings for pump motor during operation.

j. Flue-gas temperature at boiler outlet.

k. Grade or type and calorific value of fuel.

l. Draft at boiler flue-gas exit.

m. Quantity of water circulated.

n. Quantity of fuel consumed.

Indicating instruments shall be read at half-hour intervals unless otherwise directed. The Contractor shall furnish all instruments, equipment, and personnel required for the tests and balancing. Fuels, water, and electricity shall be obtained as specified in the SPECIAL CLAUSES. Operating tests shall demonstrate that fuel burners and combustion and safety controls meet the requirements of ASME CSD-1,ANSI Z21.13,NFPA 8501,and NFPA 8502.

3.6.1 Water Treatment Testing

3.6.1.1 Water Quality Test

The boiler water shall be analyzed prior to the acceptance of the facility by the water treatment company. The analysis shall include the following information recorded in accordance with ASTM D 596.

Date of Sample _____
Temperature _____degrees C
pH _____
Noncarbonate Hardness _____epm (meq/1)
Total Hardness _____epm (meq/1)

If the boiler water is not in conformance with the boiler manufacturer's recommendations, the water treatment company shall take corrective action.

3.6.1.2 Boiler/Piping Test

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At the conclusion of the 1 year period, the boiler and condensate piping shall be inspected for problems due to corrosion and scale. If the boiler is found not to conform to the manufacturer's recommendations, and the water treatment company recommendations have been followed, the water treatment company shall provide all chemicals and labor for cleaning or repairing the equipment as required by the manufacturer's recommendations.

3.7 CLEANING

3.7.1 Boilers and Piping

After the hydrostatic tests have been made and before the system is balanced and operating tests are performed, the boilers and feed water piping shall be thoroughly cleaned by filling the system with a solution consisting of either 0.5 kg of caustic soda or 0.5 kg of trisodium phosphate per 100 L of water. The proper safety precautions shall be observed in the handling and use of these chemicals. The water shall be heated to approximately 65 degrees C and the solution circulated in the system for a period of 48 hours. The system shall then be drained and thoroughly flushed out with fresh water. Strainers and valves shall be thoroughly cleaned. Prior to operating tests, air shall be removed from all water systems by operating the air vents.

3.7.2 Heating Units

Inside space heating equipment, ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided for fans that are operated during construction, and new filters shall be installed after construction dirt has been removed from the building, and the ducts, plenum, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.8 FUEL SYSTEM TESTS

3.8.1 NOT USED

3.8.2 Gas System Test

The gas fuel system shall be tested in accordance with the test procedures outlined in NFPA 54.

3.9 FIELD TRAINING

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 4 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations and boiler safety devices. The Contracting Officer shall be notified at least 14 days prior to date of proposed conduction of the training course.

--END OF SECTION--

SECTION 15569

WATER HEATING; GAS; UP TO 20 MBTUH

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TITLE AND LOCATION Discom Barracks Complex, Phase I Ft. Campbell, Kentucky	CONTRACTOR
	SPEC. SECTION 15569

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION CODE y.	DATE z.	REMARKS aa.
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			SD-19 Operation and Maintenance Manuals										
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SAFETY PAYS

SECTION 15650

CENTRAL REFRIGERATED AIR-CONDITIONING SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 210/240	(1989) Unitary Air-Conditioning and Air-Source Heat Pump Equipment
ARI 365	(1987) Commercial and Industrial Unitary Air-Conditioning Condensing Units
ARI 460	(1994) Remote Mechanical-Draft Air-Cooled Refrigerant Condensers
ARI 495	(1993) Refrigerant Liquid Receivers
ARI 520	(1990) Positive Displacement Refrigerant Compressors, Compressor Units and Condensing Units
ARI 550	(1992) Centrifugal or Rotary Screw Water-Chilling Packages
ARI 575	(1987) Method of Measuring Machinery Sound Within an Equipment Space
ARI 590	(1992) Reciprocating Water-Chilling Packages
ARI 700	(1993) Specifications for Fluorocarbon and Other Refrigerants
ARI 710	(1986) Liquid-Line Driers
ARI 720	(1988) Refrigerant Access Valves and Hose Connectors
ARI 750	(1987) Thermostatic Refrigerant Expansion Valves
ARI 760	(1987) Solenoid Valves for Use with Volatile Refrigerants

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABEMA)

ABEMA 9	(1990) Load Ratings and Fatigue Life for Ball Bearings

ABEMA 11	(1990) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S1.13	(1971; R 1986) Methods for the Measurement of Sound Pressure Levels

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1990) Ferritic Malleable Iron Castings
ASTM A 48	(1994a) Gray Iron Castings
ASTM A 53	(1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 106	(1994) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153	(1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 181	(1994) Forgings, Carbon Steel, for General-Purpose Piping
ASTM A 183	(1983; R 1990) Carbon Steel Track Bolts and Nuts
ASTM A 193	(1996) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 234	(1996) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 334	(1991) Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 733	(1993) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B 32	(1995) Solder Metal

ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1993) Seamless Copper Tube
ASTM B 88	(1993a) Seamless Copper Water Tube
ASTM B 117	(1994) Operating Salt Spray (Fog) Testing Apparatus
ASTM B 209	(1995) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 210	(1995) Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B 280	(1993a) Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B 395	(1993) U-Bend Seamless Copper and Copper Alloy Heat Exchanger and Condenser Tubes
ASTM B 650	(1993) Electrodeposited Engineering Chromium Coatings of Ferrous Substrates
ASTM C 67	(1994) Sampling and Testing Brick and Structural Clay Tile
ASTM C 534	(1994) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM D 520	(1984; R 1989) Zinc Dust Pigment
ASTM D 596	(1991) Reporting Results of Analysis of Water
ASTM D 1384	(1993) Corrosion Test for Engine Coolants in Glassware
ASTM D 1784	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2000	(1990; R 1994) Rubber Products in Automotive Applications
ASTM D 3308	(1991a) PTFE Resin Skived Tape
ASTM E 84	(1995) Surface Burning Characteristics of Building Materials
ASTM F 104	(1993) Nonmetallic Gasket Materials
ASTM F 1199	(1988, R 1993) Cast (All Temperature and Pressures) and Welded Pipe Line Strainers (150 psig and 150 degrees F Maximum)
ASTM F 1200	(1988, R 1993) Fabricated (Welded) Pipe Line Strainers

(Above 150 psig and 150 degrees F)

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONINGENGINEERS (ASHRAE)

ASHRAE 15	(1994) Safety Code for Mechanical Refrigeration
ASHRAE 34	(1994) Number Designation and Safety Classification of Refrigerants
ASHRAE 64	(1995) Methods of Testing Remote Mechanical-Draft Evaporative Refrigerant Condensers

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.5	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(1986; R 1994) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B31.1	(1995) Power Piping
ASME B31.5	(1992; B31.5a) Refrigeration Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV VIII Div 1	(1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPV IX	(1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

ASME PTC 23	(1986; Addenda 1992; R 1992) Atmospheric Water Cooling Equipment

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606	(1987) Grooved and Shouldered Joints

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS D1.1	(1994) Structural Welding Code - Steel

EXPANSION JOINT MANUFACTURERS ASSOCIATION (EJMA)

EJMA-01	(1993) EJMA Standards

HYDRAULIC INSTITUTE (HI)

HI-01	(1983) Standards for Centrifugal, Rotary, & Reciprocating Pumps

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS NDUSTRY (MSS)

MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(1995) Butterfly Valves
MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1990) Cast Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-72	(1992) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-78	(1987; R 1992) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends

MSS SP-110	(1992) Ball Valves Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA MG 1	(1993; Rev 1-1993; Rev 2-1995) Motors and Generators
NEMA SM 23	(1991) Steam Turbines for Mechanical Drive Service

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996) National Electrical Code
NFPA 90A	(1996) Installation of Air Conditioning and Ventilating Systems
NFPA 255	(1996) Method of Test of Surface Burning Characteristics of Building Materials

UNDERWRITERS LABORATORIES (UL)

UL 1995	(1990) Heating and Cooling Equipment

1.2 SYSTEM DESCRIPTION

This specification section covers the provisions and installation procedures necessary for a complete and totally functional refrigerant system. The system shall be provided and installed with all necessary System Components, Accessories, Piping Components, and Supplemental Components\Services.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Central Refrigerated Air-Conditioning System; GA.

Manufacturer's catalog data, at least 5 weeks prior to beginning construction, shall be highlighted to show model #, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Data shall include manufacturer's recommended installation instructions and procedures. Data shall be adequate to demonstrate compliance with contract requirements as specified within the paragraphs:

a. Refrigeration System

b. System Components

c. Accessories

d. Piping Components

If vibration isolation is specified for a unit, vibration isolator literature shall be included containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations.

Water Treatment Systems; GA.

Six complete copies, at least 5 weeks prior to the purchase of the water treatment system, of the proposed water treatment plan including a layout, control scheme, a list of existing make-up water conditions including the items listed in Paragraph Water Analysis, a list of chemicals, the proportion of chemicals to be added, the final treated water conditions, and a description of environmental concerns for handling the chemicals.

Spare Parts; FIO.

Spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with source of supply.

Qualifications; FIO.

Six copies of qualified procedures, and list of names and identification symbols of qualified welders and welding operators, prior to non-factory welding operations.

SD-04 Drawings

Central Refrigerated Air-Conditioning System ; GA.

Drawings, at least 5 weeks prior to beginning construction, shall provide adequate detail to demonstrate compliance with contract requirements. Drawings shall consist of:

a. Equipment layouts which identify assembly and installation details.

b. Piping layouts which identify all valves and fittings.

c. Plans and elevations which identify clearances required for maintenance and operation.

d. Wiring diagrams which identify each component individually and all interconnected or interlocked relationships between components.

e. Foundation drawings, bolt-setting information, and foundation bolts prior to concrete foundation construction for all equipment indicated or required to have concrete foundations.

f. Details, if piping and equipment are to be supported other than as indicated, which include loadings and type of frames, brackets, stanchions, or other supports.

SD-06 Instructions

Posted Instructions; GA.

Posted instructions, at least 2 weeks prior to construction completion, shall include equipment layout, wiring and control

diagrams, piping, valves and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions shall be framed under glass or laminated plastic and be posted where indicated by the Contracting Officer.

SD-07 Schedules

Tests; FIO.

Test schedules, at least 2 weeks prior to the start of related testing, for each of the field tests and the system performance tests. The schedules shall identify the date, time, and location for each test.

Demonstrations; GA.

A schedule, at least 2 weeks prior to the date of the proposed training course, which identifies the date, time, and location for the training.

SD-08 Statements

Verification of Dimensions; FIO.

A letter, at least 2 weeks prior to beginning construction, including the date the site was visited, conformation of existing conditions, and any discrepancies found.

SD-09 Reports

Field Tests; GA.

Six copies of the report shall be provided in bound 216 by 279 mm (8 1/2 by 11 inch) booklets. Reports shall document all phases of tests performed during the Water Pipe Testing, and the Refrigerant Pipe Testing. The report shall include initial test summaries, all repairs/adjustments made, and the final test results.

System Performance Tests; FIO.

Six copies of the report shall be provided in bound 216 by 279 (8 1/2 by 11 inch) booklets. The report shall document compliance with the specified performance criteria upon completion and testing of the system. The report shall indicate the number of days covered by the tests and any conclusions as to the adequacy of the system. The report shall also include the following information and shall be taken at least three different times at outside dry-bulb temperatures that are at least 3 degrees C (5 degrees F) apart:

a. Date and outside weather conditions.

b. The load on the system based on the following:
(1) The refrigerant used in the system.
(2) Condensing temperature and pressure.
(3) Suction temperature and pressure.
(4) Running current, voltage and proper phase sequence for each phase of all motors.
(5) The actual on-site setting of all operating and safety controls.
(6) Chilled water quantity and temperature in and out of the chiller.
(7) The position of the capacity-reduction gear at machine off, one-third loaded, one-half loaded, two-thirds loaded, and

fully loaded.

SD-13 Certificates

Central Refrigerated Air-Conditioning System; GA.

Where the system, components, or equipment are specified to comply with requirements of ARI, ASHRAE, ASME, or UL, proof of such compliance shall be provided. The label or listing of the specified agency shall be acceptable evidence. In lieu of the label or listing, a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency may be submitted. When performance requirements of this project's drawings and specifications vary from standard ARI rating conditions, computer printouts, catalog, or other application data certified by ARI or a nationally recognized laboratory as described above shall be included. If ARI does not have a current certification program that encompasses such application data, the manufacturer may self certify that his application data complies with project performance requirements in accordance with the specified test standards.

SD-19 Operation and Maintenance Manuals

Operation Manual; GA.

Six complete copies of an operation manual in bound 216 by 279 (81/2 by 11 inch) booklets listing step-by-step procedures required for system startup, operation, and shutdown. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.

Maintenance Manual; GA.

Six complete copies of maintenance manual in bound 216 by 279 (81/2 by 11 inch) booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping and equipment layouts and simplified wiring and control diagrams of the system as installed.

Water Treatment System; FIO.

Six complete copies of operating and maintenance manuals for the step-by-step water treatment procedures. The manuals shall include testing procedures used in determining water quality.

1.4 QUALIFICATIONS

Piping shall be welded in accordance with the qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section 05055 WELDING, STRUCTURAL.

1.5 SAFETY REQUIREMENTS

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices shall be installed so that proper operation of equipment is not impaired.

1.6 DELIVERY, STORAGE, AND HANDLING

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.7 PROJECT/SITE CONDITIONS

1.7.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

1.7.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and shall arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year use shall include applications of equipment and materials under similar circumstances and of similar size. The two years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products having less than a two-year field service record shall be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. All products shall be supported by a service organization. The Contractor shall submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and shall be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

2.2 NAMEPLATES

Each major component of equipment shall have the manufacturer's name, address, type or style, and catalog or serial number on a plate securely attached to the item of equipment. Nameplates shall be provided for:

a. Liquid-Chilling Package(s)

b. Compressor(s)

c. Compressor Driver(s)

d. Condenser(s)

e. Liquid Cooler(s)

f. Receiver(s)

g. Pump(s)

h. Pump Motor(s)

i. Refrigerant Leak Detectors

j. Expansion Tanks

k. Air Separator Tanks

2.3 ELECTRICAL WORK

Electrical equipment, motors, motor efficiencies, and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electrical characteristics and enclosure type shall be as shown, and unless otherwise indicated, all motors of 745 W (1 horsepower) and above with open, dripproof, or totally enclosed fan cooled enclosures, shall be high efficiency type. Field wiring shall be in accordance with manufacturer's instructions. Each motor shall conform to NEMA MG 1 and be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. All motors shall be continuous duty with the enclosure specified. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control indicated. Motors shall be furnished with a magnetic across-the-line or reduced voltage type starter as required by the manufacturer. Motor starter shall be provided with NEMA 3R enclosures. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided.

2.4 MATERIALS

2.4.1 Gaskets

Gaskets shall conform to ASTM F 104 - classification for compressed sheet with nitrile binder and acrylic fibers for maximum 371 degrees C (700 degrees F) service.

2.4.2 Bolts and Nuts

Bolts and nuts, except as required for piping applications, shall be in accordance with ASTM A 307. The bolt head shall be marked to identify the manufacturer and the standard with which the bolt complies in accordance with ASTM A 307.

2.4.3 Escutcheons

Escutcheons shall be chromium-plated iron or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or set screws.

2.4.4 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.4.5 Gauges

Gauges shall conform to ASME B40.1, Class 1, 2, or 3, Style X, Type I or III as required, 115 mm (4-1/2 inches) in diameter with phenolic or metal case.

2.5 REFRIGERATION SYSTEM

2.5.1 NOT USED

2.5.2 Liquid-Chilling Package; Reciprocating, Scroll, or Rotary Screw

Reciprocating or scroll unit shall be designed, fitted, tested, and rated in accordance with ARI 590 and shall meet all the requirements of ASHRAE 15. Entire unit shall be factory assembled, completely piped and wired except for units with remote condensers. Single packaged units shall be charged with refrigerant and oil ready for operation after connection to utilities. The unit shall include the following components as defined in paragraph SYSTEM COMPONENTS:

a. Refrigerant and Oil

b. Reciprocating, Scroll, or Rotary Screw Compressor

c. Compressor Driver, Electric Motor

d. Compressor Driver Connections

e. Liquid Cooler

f. Integral Air-Cooled Condenser

g. Receivers

h. Tools

i. All customary auxiliaries deemed necessary by the manufacturer for safe, controlled, automatic operation of the equipment

2.5.2.1 Capacity Criteria

Unit shall have a minimum Coefficient of Performance (COP) of 2.7 at full load rating in accordance with ARI 590. Unit shall have a minimum Integrated Part Load Value (IPLV) of 2.8 in accordance with ARI 590.

2.5.2.2 Controls Package

Each water-chilling unit shall be provided with operating and safety controls of the electric, electronic, pneumatic electric or pneumatic type. The Contractor shall properly coordinate the chiller control system with the temperature-control system specified in Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM and 15950 HEATING, VENTILATING AND AIR CONDITIONING HVAC CONTROL SYSTEMS. Temperature sensing elements shall be located as recommended by the manufacturer. Capacity reduction may be provided by cylinder unloading, by sequence operation of two or more, but shall not exceed four compressors per circuit, or by a combination of both methods. Each unit shall be provided with a factory-piped and -wired control panel fitted with:

a. A refrigerant discharge pressure and suction pressure gauge

b. A separate high-pressure cut-out with manual reset

c. A low-temperature cutout

d. Compressor operating control

e. Entering and leaving chilled water cutout

f. Operating pilot light

g. Any other relays or appurtenances necessary for safe, controlled chiller operation

h. Manual on-off switch

i. Alarm circuit terminals to actuate a minimum 100 mm (4 inch)diameter alarm bell in the event of machine cutout on any protective device, except when the low-pressure control is used as an operating control. Alarm bell shall be provided by the Contractor and located where indicated. Transformer for the bell circuit requiring low voltage shall be provided by the Contractor. Oil pressure gauge and low oil pressure cutout shall be provided on compressors which utilize positive displacement type oil pumps.

j. System capacity control, pressure or temperature actuated, on systems over 3.5 kWto adjust the unit capacity in accordance with the system load, and to automatically re-cycle the system on power interruption.

2.5.2.3 Base

Unit shall be mounted on a structural steel or cast iron base. Compressors shall be mounted on vibration isolators. The entire unit shall be isolated from the building structure on vibration isolators with published load ratings. Vibration isolators shall have isolation characteristics as recommended by the manufacturer for the unit supplied and the service intended.

2.5.2.4 Refrigerant Circuit

Each circuit shall include combination filter and drier, combination sight glass and moisture indicator, liquid-line solenoid valve, thermostatic expansion valve with external equalizer, and superheat adjustment.

2.6 SYSTEM COMPONENTS

2.6.1 Refrigerant and Oil

Refrigerants shall be one of the fluorocarbon gases. Refrigerants shall have number designations and safety classifications in accordance with ASHRAE 34. Refrigerants shall meet the requirements of ARI 700 as a minimum. Refrigerants shall have an Ozone Depletion Potential (ODP) of less than or equal to 0.05. The unit shall be factory leak tested and dehydrated. Where factory does not precharge the system, Contractor shall provide and install a complete charge of refrigerant and oil required for the installed system as recommended by the manufacturer.

2.6.2 Compressor(s)

2.6.2.1 Reciprocating Compressor(s)

All rotating parts shall be statically and dynamically balanced at the factory to minimize vibration. Compressors shall be

capable of operating at partial-load conditions without increased vibration over the normal vibration at full load operation and shall be capable of continuous operation down to the lowest step of unloading as specified. Compressors of size 7.45 kW (10 horsepower) and above shall have an oil lubrication system of the reversible, forced-feed type with oil strainer. Shaft seal in open-type units shall be mechanical type. Piston speed for open-type compressors shall not exceed the manufacturer's recommendation or 6 m/s (1200 fpm), whichever is less. Compressors shall include:

a. Vertical, V, W, or radial cylinder design

b. Oil lubrication

c. Integrally cast block of close-grained iron or cast aluminum block with hardened steel cylinder sleeves

d. Oil-level bull's eye

e. Cast cylinder heads

f. Cast-aluminum or forged-steel connecting rods

g. Cast iron or forged-steel crankshaft

h. Main bearings of the sleeve-insert type

i. Crankcase oil heaters controlled as recommended by the manufacturer

j. Suction and discharge refrigerant service valves that are flange connected, wrench operated, with cap

k. A strainer on the suction side of the compressor

l. A hot-gas muffler to reduce vibration and noise from pulsations

2.6.2.2 Scroll Compressor(s)

Compressors shall be of the compliant, hermetically sealed design. Compressors shall be mounted on vibration isolators to minimize vibration and noise. Rotating parts shall be statically and dynamically balanced at the factory to eliminate vibration. Lubrication system shall be centrifugal pump type equipped with an oil level bull's eye sight glass and an oil charging valve. Crankcase oil heater shall be provided if standard or if available as an option. If provided, the crankcase oil heater shall be controlled as recommended by the manufacturer.

2.6.5.3 Rotary Screw Compressor(s)

Compressors shall operate stably for indefinite time periods at any stage of capacity reduction without hot-gas bypass. Provision shall be made to insure proper lubrication of bearings and shaft seals on shutdown with or without electric power supply. Rotary screw compressors shall include:

a. An open or hermetic, positive displacement, oil-injected design directly driven by the compressor driver. Compressor shall allow access to internal compressor components for repairs, inspection, and replacement of parts.

b. Rotors which are solid steel forging with sufficient rigidity for proper operation.

c. A maximum rotor operating speed no greater than 3600 RPM.

d. Casings of cast iron, precision machined for minimal clearance about periphery of rotors.

e. A lubrication system of the forced-feed type that provides oil at the proper pressure to all parts requiring lubrication.

f. Shaft main bearings of the sleeve type with heavy duty bushings or rolling element type in accordance with ABEMA Std 9 or ABEMA Std 11. Bearings shall be conservatively loaded and rated for an L(10) life of not less than 200,000 hours.

g. A differential oil pressure or flow cutout to allow the compressor to operate only when the required oil pressure or flow is provided to the bearings.

h. A temperature- or pressure-initiated, hydraulically actuated, single-slide-valve, capacity-control system to provide minimum automatic capacity modulation from 100 percent to 25 percent.

i. An oil separator and oil return system to remove oil entrained in the refrigerant gas and automatically return the oil to the compressor.

j. Crankcase oil heaters controlled as recommended by the manufacturer.

2.6.3 Compressor Driver, Electric Motor

Motor starter shall be unit mounted . The compressor(s) shall be driven by an electric motor that has a maximum speed of 3,600 rpm. Motor shall be of the constant-speed, squirrel-cage induction, open enclosure, or hermetically sealed, normal- or high-torque type as required by the compressor manufacturer to adequately bring the compressor up to full operating speed without damaging the equipment. Motor shall be furnished with magnetic across-the-line or reduced-voltage motor starter as required by the unit manufacturer to limit unit total instantaneous-current flow during start-up. Motor starter shall be provided with NEMA 3R enclosures with an integral circuit breaker which trips the breaker when the starter door is opened. Hermetically sealed motors shall be refrigerant-gas cooled. Wiring shall be as recommended by the compressor manufacturer to provide completely automatic operation of the system. Motors shall be protected against running overload and motor-winding temperature overloads. All compressors shall be protected from rapid on-off cycling by a 20-minute time-delay switch initiated by unit shutdown with an adjustable time delay. Motor controller shall be suitable for starting compressor motor intermittently at 20 minute intervals continuously without damage to controller.

2.6.4 NOT USED

2.6.5 Compressor Driver Connections

Each compressor shall be driven by a V-belt drive or direct connected through a flexible coupling, except that flexible coupling is not required on hermetic units. V-belt drives shall be designed for not less than 150 percent of the driving motor capacity. Flexible couplings shall be of the type that does not require lubrication.

2.6.6 Liquid Cooler

Liquid coolers shall be designed, fitted, and rated in accordance with ARI 590 for reciprocating and scroll compressors and ARI 550 for centrifugal or rotary screw compressors. Coolers shall be designed, constructed, tested, and certified in accordance with ASME BPV VIII Div 1 as applicable, and shall comply with the provisions of ASHRAE 15. Liquid coolers shall be designed for waterside working pressures not less than 1,000 kPa (150 psig). On direct-expansion-type

units, refrigerant circuit shall be complete with liquid solenoid valve and expansion device capable of modulating to the minimum step of capacity unloading. Liquid coolers shall be of the removable or fixed-tube bundle type except that units less than 77 kW (20 tons) may be coaxial-tube type. Tubes shall be seamless copper, plain, integrally finned with smooth bore or integrally finned with enhanced bore. Nominal tube thickness shall be no less than 0.71 mm (0.028 inches). Each tube shall be individually replaceable, excluding the coaxial-tube type. Tubes shall be installed into carbon mild steel tube sheets by rolling. Tube baffles shall be carbon mild steel properly spaced to provide adequate tube support, and cross flow liquid cooler feed control shall be complete and designed to feed the cooler at all levels of capacity from 100 percent down to minimum required operating level. Performance shall be based on a water velocity not less than 0.91 m/s (3 fps) nor more than 3.7 mm (12 fps) and fouling factor of 0.00025 square meter-degree C/W (0.00075 sq. ft.-hour-degree F/btu).

2.6.7 Air-Cooled Condensing Section

2.6.7.1 Sizing

Sizing of the condenser for full capacity at design conditions shall be based on the temperature difference between the entering outside air and the condensing refrigerant for systems with stand-alone condensers that are not part of a manufacturer matched combination and cataloged system. Sizing of all other condensers for full capacity at design conditions shall be based on a maximum of 16.7 degrees C (30 degrees F) temperature difference between the entering outside air and condensing refrigerant.

2.6.7.2 Construction

Air-Cooled condenser shall be designed, fitted, tested, and rated in accordance with ARI 210/240, ARI 365, ARI 460, or ARI 590 as applicable and shall meet the requirements of ASHRAE 15. Condenser shall be an integral part of the liquid-chilling package unit. Air-cooled condenser shall be a complete factory-fabricated and assembled unit, consisting of coils, fans, and electric-motor drive. Unless the condenser coil is completely protected through inherent design, screens shall be provided by the manufacturer to prevent physical damage to the coil.

2.6.7.3 Operation

Saturated refrigerant condensing temperature shall not be over 55 degrees C (130 degrees F) unless the system can meet the unit efficiency specified on the drawings at the provided condensing temperature, in which case the manufacturer shall certify that the condenser and associated equipment are designed for the submitted condensing temperature. The saturated condensing temperature shall not exceed 63 degrees C (145 degrees F) in either case. Entering dry bulb outside design air temperature shall be as indicated. For those periods when the refrigeration system will operate over design conditions, the equipment shall be capable of operating continuously at 5.6 degrees C (10 degrees F) above stated outside design air temperature without damage or shutdown of the compressor motor or shutdown of the refrigeration system by safety devices.

2.6.7.4 Condenser Coil

Condenser coil shall be of the extended-surface fin-and-tube type and shall be constructed of seamless copper or aluminum tubes with compatible copper or aluminum fins. On condensers with all aluminum construction, tubes shall conform to ASTM B 210; alloy 1100, and aluminum alloy conforming to chemical requirements of ASTM B 209, alloy 7072 shall be used for the fins and end sheets. Fins shall be soldered or mechanically bonded to the tubes and installed in a metal casing. Coil shall be tested after assembly at pressure specified in ASHRAE 15 for the refrigerant employed in the system.

2.6.7.5 Fans

Fans shall be centrifugal or propeller type as best suited for the application. Fans shall be direct or V-belt driven. Belt drives shall be completely enclosed within the unit casing or equipped with a guard. When belt drive is provided, an adjustable sheave to furnish not less than 20 percent fan-speed adjustment shall be provided. Sheaves shall be selected to provide the capacity indicated at the approximate midpoint of the adjustment. Fans shall be statically and dynamically balanced.

2.6.7.6 Condenser Casing

Condenser casing shall be aluminum not less than 2 mm (0.080 inch) or hot-dip galvanized steel not lighter than 1.2 mm (18 gauge). Condensers having horizontal air discharge shall be provided with discharge baffle to direct air upward, constructed of the same material and thickness as the casing.

2.6.7.7 Refrigerant Storage

Air-cooled condenser may be used for refrigerant storage in lieu of a separate receiver, if the condenser storage capacity is 5 percent in excess of the fully charged system for packaged air-cooled chillers and air-cooled condensing units with field installed refrigerant piping no longer than recommended by the manufacturer; 20 percent for all air-cooled condensers; and 20 percent for all air-cooled condensing units with field installed piping which is longer than recommended by the manufacturer.

2.6.7.8 Condenser Controls

If the equipment or system served by the condenser requires control of head pressure either air volume head pressure control or condenser flooding head pressure control shall be provided which meets the following requirements:

a. Air Volume Control: On a decrease in refrigerant discharge pressure, volume-control dampers shall modulate to control the airflow over the condenser coil. Solid-state variable-speed fan motor controller may be provided in lieu of volume dampers to control the air flow over the coil. Condensers with multiple fans may be provided with fan cycling control to cycle fans in response to outdoor ambient temperature. Control shall be set for minimum of 35 degrees C (95 degrees F) saturated refrigerant condensing temperature.

2.6.8 through 2.6.10 NOT USED

2.6.11 Receivers

Liquid receivers not already specified herein as an integral factory-mounted part of a package, shall be designed, fitted, and rated in accordance with the recommendations of ARI 495, except as modified herein. Receiver shall bear a stamp certifying compliance with ASME BPV VIII Div 1 and shall meet the requirements of ASHRAE 15. Inner surfaces shall be thoroughly cleaned by sandblasting or other approved means. Each receiver shall have a storage capacity not less than 20 percent in excess of that required for the fully-charged system. Each receiver shall be equipped with inlet, outlet drop pipe, drain plug, purging valve, relief valves of capacity and setting required by ASHRAE 15, and two bull's eye liquid-level sight glasses. Sight glasses shall be in the same vertical plane, 90 degrees apart, perpendicular to the axis of the receiver, and not over 75 mm horizontally from the drop pipe measured along the axis of the receiver. In lieu of bull's eye sight glass, external gauge glass with metal glass guard and automatic closing stop valves may be provided.

2.6.12 NOT USED

2.6.13 Tools

One complete set of special tools as recommended by the manufacturer for field maintenance of the system shall be

provided. Tools shall be mounted on a tool board in the equipment room or contained in a toolbox as directed by the Contracting Officer.

2.7 ACCESSORIES

2.7.1 Pumps

Pumps shall be the electrically driven, non-overloading, centrifugal type which conform to HI-01. Pump capacity, efficiency, motor size, and impeller type shall be as indicated on the drawings. Pumps shall be selected at or near peak efficiency. Pump curve shall rise continuously from maximum capacity to shutoff. Shutoff head shall be approximately 20 percent greater than design head. Pump motor shall be totally enclosed and have sufficient wattage (horsepower) for the service required. Each pump motor shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in the cover.

2.7.1.1 Construction

Shaft seal shall be mechanical-seal or stuffing-box type. Impeller shall be statically and dynamically balanced. Each pump casing shall be designed to withstand the discharge head specified plus the static head on system plus 50 percent of the total, but not less than 862 kPa (125 psig). Pump casing and bearing housing shall be close grained cast iron. High points in the casing shall be provided with manual air vents; low points shall be provided with drain plugs. Impeller, impeller wearing rings, glands, casing wear rings, and shaft sleeve shall be bronze. Shaft shall be carbon or alloy steel, turned and ground. Bearings shall be ball-bearings, roller-bearings, or oil-lubricated bronze-sleeve type bearings, and be efficiently sealed or isolated to prevent loss of oil or entrance of dirt or water. Pump and motor shall be mounted on a common cast iron base having lipped edges and tapped drainage openings or structural steel base with lipped edges or drain pan and tapped drainage openings. Pump shall be provided with shaft coupling guard.Close coupled pumps shall be provided with drip pockets and tapped openings.Pump motor shall have the required capacity to prevent overloading with pump operating at any point on its characteristic curve. Pump speed shall not exceed 3,600 rpm, except where the pump head is less than 180 kPa,the pump speed shall not exceed 1,750 rpm. Pump shall be accessible for servicing without disturbing piping connections.

2.7.1.2 Mechanical Shaft Seals

Seals shall be single, inside mounted, end-face-elastomer bellows type with stainless steel spring, brass or stainless steel seal head, carbon rotating face, and tungsten carbide sealing face. Glands shall be bronze and of the water-flush design to provide lubrication flush across the face of the seal. Bypass line from pump discharge to flush connection in gland shall be provided, with filter or cyclone separator in line.

2.7.1.3 Stuffing-Box Type Seals

Seals shall be single unit construction separate from the casing, secured against rotation. Stuffing box shall include minimum 5 rows of square, graphite braided asbestos packing and a bronze split-lantern ring. Packing gland shall be bronze interlocking split type.

2.7.2 Expansion Tanks

Expansion tanks shall be welded steel, constructed, tested and stamped in accordance with ASME BPV VIII Div 1 for a working pressure of 862 kPa (125 psig) and precharged to the minimum operating pressure. Expansion tanks shall have a replaceable diaphragm and be the captive air type. Tanks shall accommodate expanded water of the system generated within the normal operating temperature range, limiting this pressure increase at all components in the system to the maximum allowable pressure at those components. Each tank air chamber shall be fitted with an air charging valve.

Tanks shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations. The only air in the system shall be the permanent sealed-in air cushion contained within the expansion tank.

2.7.3 Air Separator Tanks

External air separation tank shall be steel, constructed, tested, and stamped in accordance with ASME BPV VIII Div 1 for a working pressure of 862 kPa (125 psig).

2.7.4 NOT USED

2.7.5 NOT USED

2.7.6 Pump-Out System

A manually initiated pump-out system shall be provided, consisting of a motor-driven, air- or water-cooled, reciprocating condensing unit and a receiver of sufficient capacity to store the entire refrigerant charge of the largest water-chilling system or unit when 80 percent full at 32 degrees C. Pump-out system condensing unit shall be assembled as a complete unit and meet the requirements of ASHRAE 15. Receiver and relief devices shall conform to requirements of ASME BPV VIII Div 1. Unit shall be mounted on the chiller or mounted on floor brackets and provided with rupture members and unit relief valves in series. Entire system shall be complete with all valves, piping, and controls so that the pump-out system may be operated without requiring any temporary wiring or piping. The pump-out system shall be capable of removing both refrigerant liquid and refrigerant vapor from the refrigeration system. The pump-out system shall be capable of reducing the pressure within the refrigeration system to 150 mm Hg.

2.7.7 Insulation

2.7.7.1 Field Installed Insulation

Field installed insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEM, except for header and waterbox insulation which shall be flexible cellular insulation in accordance with ASTM C 534, Type I.

2.7.7.2 Factory Installed Insulation

For Liquid-Chilling Packages (Reciprocating or Scroll), insulation shall be provided on all suction piping from the evaporator to the compressor and on the liquid cooler including chilled water boxes or headers.

2.8 NOT USED

2.9 WATER TREATMENT SYSTEMS

When water treatment is specified, the use of chemical-treatment products containing hexavalent chromium (Cr) is prohibited.

2.9.1 NOT USED

2.9.2 Chilled Water

Water to be used in the chilled water systems shall be treated to maintain the conditions recommended by this specification as well as the recommendations from the manufacturers of the evaporator coils. Chemicals shall meet all

required federal, state, and local environmental regulations for the treatment of evaporator coils and direct discharge to the sanitary sewer.

2.9.3 NOT USED

2.9.4 NOT USED

2.9.5 Chilled Water System

A shot feeder shall be provided on the chilled water piping as indicated. Size and capacity of feeder shall be based on local requirements and water analysis. The feeder shall be furnished with an air vent, gauge glass, funnel, valves, fittings, and piping.

2.10 PIPING COMPONENTS

2.10.1 Water Piping and Fittings

2.10.1.1 Steel Pipe

Steel pipe shall conform to ASTM A 53, Schedule 40, Type E or S, Grades A or B. Type F pipe shall not be used.

2.10.1.2 Steel Pipe Joints and Fittings

Joints and fittings shall be welded, flanged, threaded, or grooved as indicated. If not otherwise indicated, piping 25 mm (1 inch) and smaller shall be threaded; piping larger than 25 mm (1 inch) and smaller than 80 mm (3 inches) shall be either threaded, grooved, or welded; and piping 80 mm (3 inches) and larger shall be grooved, welded, or flanged. Rigid grooved mechanical joints and fittings may only be used in serviceable aboveground locations where the temperature of the circulating medium does not exceed 110 degrees C. Flexible grooved joints shall be used only as a flexible connector with grooved pipe system. Unless otherwise specified, grooved piping components shall meet the corresponding criteria specified for the similar welded, flanged, or threaded component specified herein. The manufacturer of each fitting shall be permanently identified on the body of the fitting in accordance with MSS SP-25.

a. Welded Joints and Fittings: Welded fittings shall conform to ASTM A 234, and identified with the appropriate grade and marking symbol. Butt-welding fittings shall conform to ASME B16.9. Socket-welding and threaded fittings shall conform to ASME B16.11.

b. Flanged Joints and Fittings: Flanges shall conform to ASTM A 181 and ASME B16.5 Class 150. Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1.59 mm (1/16 inch) thickness, full face or self-centering flat ring type. These gaskets shall contain aramid fibers bonded with styrene butadeine rubber (SBR) or nitrile butadeine rubber (NBR). Bolts, nuts, and bolt patterns shall conform to ASME B16.5. Bolts shall be high or intermediate strength material conforming to ASTM A 193.

c. Threaded Joints and Fittings: Threads shall conform to ASME B1.20.1. Pipe nipples shall conform to ASTM A 733, type and material to match adjacent piping. Unions shall conform to ASME B16.39, type as required to match adjacent piping.

d. Dielectric Unions and Flanges: Dielectric unions shall have the tensile strength and dimensional requirements specified. Unions shall have metal connections on both ends threaded to match adjacent piping. Metal parts of dielectric unions shall be separated with a nylon insulator to prevent current flow between dissimilar metals. Unions shall be suitable for the required operating pressures and temperatures. Dielectric flanges shall provide the same

pressure ratings as standard flanges and provide complete electrical isolation.

e. Grooved Mechanical Joints and Fittings: Joints and fittings shall be designed for not less than 862 kPa (125 psig) service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12; or steel conforming ASTM A 106, Grade B or ASTM A 53. Gaskets shall be molded synthetic rubber with central cavity, pressure responsive configuration and shall conform to ASTM D 2000 Grade No. 2CA615A15B44F17Z for circulating medium up to 110 degrees C (230 degrees F)or Grade No. M3BA610A15B44Z for circulating medium up to 93 degrees C (200 degrees F). Grooved joints shall conform to AWWA C606. Coupling nuts and bolts shall be steel and shall conform to ASTM A 183.

2.10.1.3 Copper Tube

Copper tubing for water service shall conform to ASTM B 88, Type K or L.

2.10.1.4 Copper Tube Joints and Fittings

Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B 75. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used.

2.10.2 Water Piping Valves and Accessories

Valves shall be rated for Class 125 and shall be suitable for operating temperature of 120 degrees C (250 degrees F). Valves shall be suitable for the working pressure of the pipe in which installed. Valves shall meet the material, fabrication and operating requirements of ASME B31.1. Chain operators shall be provided for valves located 3 m or higher above the floor. Valves in sizes larger than 25 mm (1 inch) and used on steel pipe systems, may be provided with rigid grooved mechanical joint ends. Such grooved end valves shall be subject to the same requirements as rigid grooved mechanical joints and fittings and, shall be provided by the same manufacturer as the grooved pipe joint and fitting system.

2.10.2.1 Gate Valves

Gate valves 65 mm (2-1/2 inches) and smaller shall conform to MSS SP-80 and shall be bronze with rising stem and threaded, soldered, or flanged ends. Gate valves 80 mm (3 inches) and larger shall conform to MSS SP-70, Type I, II, Class 125, Design OF and shall be cast iron with bronze trim, outside screw and yoke, and flanged or threaded ends.

2.10.2.2 Globe and Angle Valves

Globe and angle valves 65 mm (2-1/2 inches) and smaller shall conform to MSS SP-80 and shall be bronze with threaded, soldered, or flanged ends. Globe and angle valves 80 mm (3 inches) and larger shall conform to MSS SP-85 and shall be cast iron with bronze trim and flanged or threaded ends.

2.10.2.3 Check Valves

Check valves 65 mm (2-1/2 inches) and smaller shall conform to MSS SP-80 and shall be bronze with threaded, soldered, or flanged ends. Check valves 80 mm (3 inches) and larger shall conform to MSS SP-71, Type I, II, III, or IV, Class 125 or 150 and shall be cast iron with bronze trim and flanged or threaded ends.

2.10.2.4 NOT USED

2.10.2.5 Plug Valves

Plug valves 50 mm (2 inches) and larger shall conform to MSS SP-78, have flanged or threaded ends, and have cast iron bodies with bronze trim. Valves 50 mm (2 inches) and smaller shall be bronze with NPT connections for black steel pipe and brazed connections for copper tubing. Valves shall be lubricated, non-lubricated, or tetrafluoroethylene resin-coated type. Valves shall be resilient, double seated, trunnion mounted with tapered lift plug capable of 2-way shutoff. Valves shall operate from fully open to fully closed by rotation of the handwheel to lift and turn the plug. Valves shall a weatherproof operators with mechanical position indicators. Valves 200 mm (8 inches) or larger shall be provided with manual gear operators with position indicators.

2.10.2.6 Ball Valves

Ball valves 15 mm (1/2 inch) and larger shall conform to MSS SP-72 or MSS SP-110 and shall be ductile iron or bronze with threaded, soldered, or flanged ends.

2.10.2.7 Calibrated Balancing Valves

Each valve shall be calibrated so that flow can be determined when the temperature and pressure differential across valve is known. Valves shall have an integral pointer which registers the degree of valve opening. Each valve shall be constructed with internal seals to prevent leakage and shall be supplied with preformed insulation. Valve Cv rating shall be as indicated. Valve bodies shall be provided with tapped openings and pipe extensions with positive shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable meter to measure the pressure differential. One portable differential meter, suitable for the operating pressure specified, shall be provided. The meter shall be complete with hoses, vent, integral metering connections, and carrying case as recommended by the valve manufacturer. In lieu of the balancing valve with integral metering connections, a ball valve or plug valve with a separately installed orifice plate or venturi tube may be used for balancing.

2.10.2.8 NOT USED

2.10.2.9 Air Vents

Manual air vents shall be brass or bronze valves or cocks suitable for 862 kpa (125 psig) service, and furnished with threaded plugs or caps. Automatic air vents shall be float type, cast iron, stainless steel, or forged steel construction, suitable for 862 kpa (125 psig) service.

2.10.2.10 Strainers

Strainers shall be in accordance with ASTM F 1199, except as modified herein. Strainer shall be the cleanable, basket or "Y" type, the same size as the pipeline. The strainer bodies shall be fabricated of cast iron with bottoms drilled, and tapped. The bodies shall have arrows clearly cast on the sides indicating the direction of flow. Each strainer shall be equipped with removable cover and sediment screen. The screen shall be made of minimum 0.8 mm (22 gauge) brass sheet, monel, or corrosion-resistant steel,with small perforations numbering not less than 60 per square centimeter (400 per square inch) to provide a net free area through the basket of at least 3.30 times that of the entering pipe. The flow shall be into the screen and out through the perforations.

2.10.2.11 Combination Strainer and Suction Diffuser

A combination strainer and suction diffuser, consisting of an angle type body with removable strainer basket and

straightening vanes, a suction pipe support, and a blowdown outlet, shall be provided on pump suction. The combination strainer and suction diffuser shall be in accordance with ASTM F 1199, except as modified herein.

2.10.2.12 Pump Discharge Valves

Pump discharge valves shall be installed where indicated and shall perform the functions of a nonslam check valve, a manual balancing valve, and a shutoff. Valves shall be of cast iron or ductile iron construction with bronze and/or stainless steel accessories. Valves shall have an integral pointer which registers the degree of valve opening. Flow through the valve shall be manually adjustable from bubble tight shutoff to full flow. Valves smaller than 50 mm (2 inches) shall have NPT connections. Valves 50 mm (2 inches) and larger shall have flanged or grooved end connections. The valve design shall allow the back seat for the stem to be replaced in the field under full line pressure. Valve Cv rating shall be as indicated.

2.10.2.13 Backflow Preventers

Backflow preventers shall be in accordance with Section 15400 PLUMBING, GENERAL PURPOSE.

2.10.2.14 Flexible Pipe Connectors

Flexible pipe connectors shall be designed for 862 kpa (125 psig) or 1034 kPa (150 psig) service as appropriate for the static head plus the system head, and 120 degrees C (250 degrees F), for grooved end flexible connectors. The flexible section shall be constructed of rubber, tetrafluoroethylene resin, or corrosion-resisting steel, bronze, monel, or galvanized steel. The flexible section shall be suitable for intended service with end connections to match adjacent piping. Flanged assemblies shall be equipped with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Covers to protect the bellows shall be provided where indicated.

2.10.2.15 Pressure Gauges

Gauges shall conform to ASME B40.1 and shall be provided with throttling type needle valve or a pulsation dampener and shut-off valve. Gauge shall be a minimum of 85 mm in diameter with a range from 0 kPa (0 psig) to approximately 1.5 times the maximum system working pressure.

2.10.2.16 Thermometers

Thermometers shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 225 mm (9 inch) scale. Thermometers shall have rigid stems with straight, angular, or inclined pattern.

2.10.2.17 Pipe Nipples

Pipe nipples shall be in accordance with ASTM A 733 and be of material to match adjacent piping.

2.10.2.18 Pipe Unions

Pipe unions shall be in accordance with ASME B16.39 and be of material to match adjacent piping.

2.10.2.19 Solder

Solder for water piping shall be in accordance with ASTM B 32, alloy grade 50B.

2.10.3 Expansion Joints

2.10.3.1 Slip-Tube Joints

Expansion joints shall provide for either single or double slip of the connected pipes, as required or indicated, and for not less than the traverse indicated. The joints shall be designed for working temperature and pressure suitable for the application, but not less than 1034 kPa (150 psig), and shall be in accordance with applicable requirements of EJMA-01 and ASME B31.1. End connections shall be flanged or beveled for welding as indicated. Joints shall be provided with an anchor base where required or indicated. Where adjoining pipe is carbon steel, the sliding slip shall be seamless steel plated with a minimum of 0.12 mm of hard chrome in accordance with ASTM B 650. All joint components shall be suitable for the intended service. Initial settings shall be made in accordance with the manufacturer's recommendations to compensate for ambient temperature at time of installation. Pipe alignment guides shall be installed as recommended by the joint manufacturer. Pipe alignment guides shall in no case be more than 1.5 mfrom expansion joints except for pipe 100 mm (4 inches) or smaller. Pipe alignment guides on pipe 100 mm (4 inches) or smaller shall be installed not more than 600 mm from expansion joints. Service outlets shall be provided where indicated.

2.10.3.2 Flexible Ball Joints

Flexible ball joints shall be constructed of alloys as appropriate for the service intended. Where so indicated, the ball joint shall be designed for packing injection under full line pressure to contain leakage. The joint ends shall be threaded to 50 mm (2 inches) only, grooved, flanged, or beveled for welding as indicated or required and shall be capable of absorbing a minimum of 15 degree angular flex and 360 degree rotation. Ball and sockets shall be suitable for the intended service. The exterior spherical surface of carbon steel balls shall be plated with minimum 0.12 mm of hard chrome in accordance with EJMA-01 and ASME B31.1 where applicable. Where required, flanges shall conform to ASME B16.5.

2.10.3.3 Bellows Type Joints

Bellows type joints shall be flexible, guided expansion joints. The expansion element shall be stabilized corrosion resistant steel. Bellows type expansion joints shall conform to the applicable requirements of EJMA-01 and ASME B31.1 with internal sleeves. Guiding of piping on both sides of expansion joint shall be in accordance with the published recommendations of the manufacturer of the expansion joint. The joints shall be designed for the working temperature and pressure suitable for the application but not less than 1034 kPa (150 psig).

2.10.4 Refrigerant Piping and Fittings

Refrigerant piping, valves, fittings, and accessories shall conform to the requirements of ASHRAE 15 and ASME B31.5, except as specified.

2.10.4.1 Steel Pipe

Steel pipe for refrigerant service shall conform to ASTM A 53, Schedule 40, Type E or S, Grades A or B. Type F pipe shall not be used.

2.10.4.2 Steel Pipe Joints and Fittings

Joints and fittings shall be steel butt-welding, socket-welding, or malleable iron threaded type. Pipe shall be welded except that joints on lines 50 mm (2 inches) and smaller may be threaded. Threads shall be tapered type conforming to

ASME B1.20.1. The malleable iron threaded type fitting shall be of a weight corresponding to adjacent pipe. Flanges and flange faces of fittings shall be tongue-and-groove type with gaskets suitable for the refrigerant used; size 25 mm (1 inch) and smaller shall be oval, two-bolt type; size above 25 mm (1 inch), up to and including 100 mm (4 inches), shall be square four-bolt type; and sizes over 100 mm (4 inches) shall be round.

2.10.4.3 Steel Tubing

Steel tubing for refrigeration service shall be in accordance with ASTM A 334, Grade 1. Tubing with a nominal diameter of 10 mm (3/8 inch) or 15 mm (1/2 inch) shall have a wall thickness of 1.24 mm (0.049 inches). Tubing with a nominal diameter of 20 mm (3/4 inch) through 50 mm (2 inches) shall have a wall thickness of 1.65 mm (0.065 inches). Tubing with a nominal diameter of 65 mm (2-1/2 inches) through 100 mm (4 inches) shall have a wall thickness of 2.41 mm (0.095 inches). Steel tubing shall be cold-rolled, electric-forged, welded-steel. One end of the tubing shall be provided with a socket. Steel tubing shall be cleaned, dehydrated, and capped.

2.10.4.4 Steel Tubing Joints and Fittings

Joints and fittings shall be socket type provided by the steel tubing manufacturer.

2.10.4.5 Copper Tubing

Copper tubing shall conform to ASTM B 280 annealed or hard drawn as required. Copper tubing shall be soft annealed where bending is required and hard drawn where no bending is required. Soft annealed copper tubing shall not be used in sizes larger than 35 mm (1-3/8 inches). Joints shall be brazed except that joints on lines 22 mm (7/8 inch) and smaller may be flared.

2.10.4.6 Copper Tube Joints and Fittings

Copper tube joints and fittings shall be flare joint type with short-shank flare, or solder-joint pressure type. Joints and fittings for brazed joint shall be wrought-copper or forged-brass sweat fittings. Cast sweat-type joints and fittings shall not be allowed for brazed joints.

2.10.5 Refrigerant Piping, Valves, and Accessories

Valves shall be pressure and temperature rates for contained refrigerant service and shall comply with ASME B31.5. Metals of constructions shall be ferrous or copper based. Atmosphere exposed valve stems shall be stainless steel or corrosion resistant metal plated carbon steel. Valve body connections shall not be used, except in pilot pressure or gauge lines where maintenance disassembly is required and welded flanges cannot be used. Valves shall be suitable for or fitted with extended copper ends for brazing in-place without disassembly. Ferrous body valves shall be fitted with factory fabricated and brazed copper transitions. To minimize system pressure drops, where practicable, globe valves shall be angle body type, and straight line valves shall be full port ball type. Control valve inlets shall be fitted with integral or adapted strainer or filter where recommended or required by the manufacturer. Valves shall be cleaned and sealed moisture-tight.

2.10.5.1 Refrigerant-Stop Valves

Valves, in sizes through 15 mm (5/8 inch), shall be handwheel operated, straight or angle, packless diaphragm globe type with back-seating stem, brazed ends, except where SAE flare or retained seal cap connections are required. In sizes over 15 mm (5/8 inch), valves shall be globe or angle type, wrench operated with ground-finish stems, or ball valves, packed especially for refrigerant service, back seated, and provided with seal caps. Refrigerant isolation and shut-off valves shall have retained or captive spindles and facilities for tightening or replacement of the gland packing

under line pressure as applicable. Stop valves hall have back-seating plated steel stem, bolted bonnet in sizes 25 mm (1-1/8 inches) OD and larger, integral or flanged transition brazed socket. Valves in sizes through 65 mm (2-1/2 inches) shall be end-entry body assembly, full-port, floating ball type, with equalizing orifice fitted chrome plated ball, seats and seals of tetrafluoroethylene, chrome plated or stainless steel stem, and seal cap. In sizes 100 mm (4 inch) IPS and larger, and in smaller sizes where carbon steel piping is used, valve bodies shall be tongue and groove flanged and complete with mating flange, gaskets and bolting for socket or butt-welded connection. Purge, charge and receiver valves shall be of manufacturer's standard configuration.

2.10.5.2 Check Valves

Valve shall be designed for service application, spring-loaded type where required, with resilient seat and with flanged body in sizes 15 mm (1/2 inch) and larger. Valve shall provide positive shutoff at 10 kPa (1-1/2 psi) differential pressure.

2.10.5.3 Liquid Solenoid Valves

Valves shall comply with ARI 760 and be suitable for continuous duty with applied voltages 15 percent under and 5 percent over nominal rated voltage at maximum and minimum encountered pressure and temperature service conditions. Valves shall be direct-acting or pilot-operating type, packless, except that packed stem, seal capped, manual lifting provisions shall be furnished. Solenoid coils shall be moisture-proof, UL approved, totally encapsulated or encapsulated and metal jacketed as required. Valves shall have safe working pressure of 2760 kPa (400 psi) and a maximum operating pressure differential of at least 1375 kPa (200 psi) at 85 percent rated voltage. Valves shall have an operating pressure differential suitable for the refrigerant used.

2.10.5.4 Expansion Valves

Expansion valves shall conform to requirements of ARI 750. Valve shall be of the diaphragm and spring type with internal or external equalizers, and bulb and capillary tubing. Valve shall be provided with an external superheat adjustment along with a seal cap. Internal equalizers may be utilized where flowing refrigerant pressure drop between outlet of the valve and inlet to the evaporator coil is negligible and pressure drop across the evaporator is less than the pressure difference corresponding to 1 degrees C (2 degrees F) of saturated suction temperature at evaporator conditions. Bulb charge shall be determined by the manufacturer for the application and such that liquid will remain in the bulb at all operating conditions. Gas limited liquid charged valves and other valve devices for limiting evaporator pressure shall not be used without a distributor or discharge tube or effective means to prevent loss of control when bulb becomes warmer than valve body. Pilot-operated valves shall have a characterized plug to provide required modulating control. A de-energized solenoid valve may be used in the pilot line to close the main valve in lieu of a solenoid valve in the main liquid line. An isolatable pressure gauge shall be provided in the pilot line, at the main valve. Automatic pressure reducing or constant pressure regulating expansion valves may be used only where indicted or for constant evaporator loads.

2.10.5.5 Safety Relief Valves

Valve shall be two-way type. Single type valves shall be used only where indicated. Valve shall bear the ASME code symbol. Valve capacity shall be certified by the National Board of Boiler and Pressure Vessel Inspectors. Valve shall be of an automatically reseating design after activation.

2.10.5.6 Evaporator Pressure Regulators, Direct-Acting

Valve shall include a diaphragm/spring assembly, external pressure adjustment with seal cap, and pressure gauge port. Valve shall maintain a constant inlet pressure by balancing inlet pressure on diaphragm against an adjustable spring

load. Pressure drop at system design load shall not exceed the pressure difference corresponding to a 1 degrees C change in saturated refrigerant temperature at evaporator operating suction temperature. Spring shall be selected for indicated maximum allowable suction pressure range.

2.10.5.7 Refrigerant Access Valves

Refrigerant access valves and hose connections shall be in accordance with ARI 720.

2.10.5.8 Filter Driers

Driers shall conform to ARI 710. Sizes 15 mm (5/8 ich) and larger shall be the full flow, replaceable core type. Sizes 15 mm (1/2 inch) and smaller shall be the sealed type. Cores shall be of suitable desiccant that will not plug, cake, dust, channel, or break down, and shall remove water, acid, and foreign material from the refrigerant. Filter driers shall be constructed so that none of the desiccant will pass into the refrigerant lines. Minimum bursting pressure shall be 10.3 MPa (1,500 psi).

2.10.5.9 Sight Glass and Liquid Level Indicator

a. Assembly and Components: Assembly shall be pressure- and temperature-rated and constructed of materials suitable for the service. Glass shall be borosilicate type. Ferrous components subject to condensation shall be electro-galvanized.

b. Gauge Glass: Gauge glass shall include top and bottom isolation valves fitted with automatic checks, and packing followers; red-line or green-line gauge glass; elastomer or polymer packing to suit the service; and gauge glass guard.

c. Bull's-Eye and Inline Sight Glass Reflex Lens: Bull's-eye and inline sight glass reflex lens shall be provided for dead-end liquid service. For pipe line mounting, two plain lenses in one body suitable for backlighted viewing shall be provided.

d. Moisture Indicator: Indicator shall be a self-reversible action, moisture reactive, color changing media. Indicator shall be furnished with full-color-printing tag containing color, moisture and temperature criteria. Unless otherwise indicated, the moisture indicator shall be an integral part of each corresponding sight glass.

2.10.5.10 Vibration Dampeners

Dampeners shall be of the all-metallic bellows and woven-wire type.

2.10.5.11 Flexible Pipe Connectors

Connector shall be pressure and temperature rated for the service in accordance with ASHRAE 15 and ASME B31.5. Connector shall be a composite of interior corrugated phosphor bronze or Type 300 Series stainless steel, as required for fluid service, with exterior reinforcement of bronze, stainless steel or monel wire braid. Assembly shall be constructed with a safety factor of not less than 4 at 150 degrees C (300 degrees F). Unless otherwise indicated, the length of a flexible connector shall be as recommended by the manufacturer for the service intended.

2.10.5.12 Strainers

Strainers used in refrigerant service shall have brass or cast iron body, Y-or angle-pattern, cleanable, not less than 60-mesh noncorroding screen of an area to provide net free area not less than ten times the pipe diameter with pressure rating compatible with the refrigerant service. Screens shall be stainless steel or monel and reinforced spring-loaded

where necessary for bypass-proof construction.

2.10.5.13 Brazing Materials

Brazing materials for refrigerant piping shall be in accordance with AWS A5.8, Classification BCuP-5.

2.11 FABRICATION

2.11.1 Factory Coating

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand 500 hours exposure to the salt spray test specified in ASTM B 117 using a 5 percent sodium chloride solution. Immediately after completion of the test, the specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 3 mm on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D 520, Type I.

2.11.2 Field Painting

Painting required for surfaces not otherwise specified, and finish painting of items only primed at the factory are specified in Section 09900 PAINTING, GENERAL.

2.11.2.1 Color Coding

Color coding for piping identification is specified in Section 09900 PAINTING, GENERAL.

2.11.2.2 Color Coding Scheme

A color coding scheme for locating hidden piping shall be in accordance with Section 15400 PLUMBING, GENERAL PURPOSE.

2.12 NOT USED

2.13 SUPPLEMENTAL COMPONENTS\SERVICES

2.13.1 Drain and Makeup Water Piping

Piping shall comply with the requirements of Section 15400 PLUMBING, GENERAL PURPOSE. Drains which connect to sanitary sewer system shall be connected by means of an indirect waste.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be performed in accordance with the manufacturer's published diagrams, recommendations, and equipment warranty requirements. Where equipment is specified to conform to the requirements of ASME BPV VIII Div 1 and ASME BPV IX, the design, fabrication, and installation of the system shall conform to ASME BPV VIII Div 1 and ASME BPV IX.

SAFETY PAYS

3.1.1 Refrigeration System

3.1.1.1 Equipment

Necessary supports shall be provided for all equipment, appurtenances, and pipe as required, including frames or supports for compressors, pumps, cooling towers, condensers, liquid coolers, and similar items. Compressors shall be isolated from the building structure. If mechanical vibration isolators are not provided, vibration absorbing foundations shall be provided. Each foundation shall include isolation units consisting of machine and floor or foundation fastenings, together with intermediate isolation material. Other floor-mounted equipment shall be set on not less than a 150 mmconcrete pad doweled in place. Concrete foundations for floor mounted pumps shall have a mass equivalent to three times the weight of the components, pump, base plate, and motor to be supported. In lieu of concrete pad foundation, concrete pedestal block with isolators placed between the pedestal block and the floor may be provided. Concrete pedestal block shall be of mass not less than three times the combined pump, motor, and base weights. Isolators shall be selected and sized based on load-bearing requirements and the lowest frequency of vibration to be isolated. Lines connected to pumps mounted on pedestal blocks shall be provided with flexible connectors. Foundation drawings, bolt-setting information, and foundation bolts shall be furnished prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Concrete for foundations and concrete-structured or cased-cooling towers shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Equipment shall be properly leveled, aligned, and secured in place in accordance with manufacturer's instructions.

3.1.1.2 Refrigerant Charging

a. Initial Charge: Upon completion of all the refrigerant pipe tests, the vacuum on the system shall be broken by adding the required charge of dry refrigerant for which the system is designed, in accordance with the manufacturer's recommendations. Contractor shall provide the complete charge of refrigerant in accordance with manufacturer's recommendations. Upon satisfactory completion of the system performance tests, any refrigerant that has been lost from the system shall be replaced. After the system is fully operational, service valve seal caps and blanks over gauge points shall be installed and tightened.

b. Refrigerant Leakage: If a refrigerant leak is discovered after the system has been charged, the leaking portion of the system shall immediately be isolated from the remainder of the system and the refrigerant shall be pumped into the system receiver or other suitable container. The refrigerant shall not be discharged into the atmosphere.

c. Contractor's Responsibility: The Contractor shall, at all times during the installation and testing of the refrigeration system, take steps to prevent the release of refrigerants into the atmosphere. The steps shall include, but not be limited to, procedures which will minimize the release of refrigerants to the atmosphere and the use of refrigerant recovery devices to remove refrigerant from the system and store the refrigerant for reuse or reclaim. At no time shall more than 85 g of refrigerant be released to the atmosphere in any one occurrence. Any system leaks within the first year shall be repaired in accordance with the specified requirements including material, labor, and refrigerant if the leak is the result of defective equipment, material, or installation.

3.1.1.3 Oil Charging

Except for factory sealed units, two complete charges of lubricating oil for each compressor crankcase shall be furnished. One charge shall be used during the performance testing period, and upon the satisfactory completion of the tests, the oil shall be drained and replaced with the second charge.

3.1.1.4 Automatic Controls

Automatic controls for the central refrigeration system specified in paragraph REFRIGERATION SYSTEM shall be

provided with the central refrigeration equipment. These controls shall operate automatically to balance the equipment capacity with the load on the air conditioning system, and shall be fully coordinated with and integrated into the temperature control system specified in Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM and 15950 HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS.

3.1.2 General Piping Installation

3.1.2.1 Brazed Joints

Before brazing copper joints, both the outside of the tube and the inside of the fitting shall be cleaned with a wire fitting brush until the entire joint surface is bright and clean. Brazing flux shall not be used. Surplus brazing material shall be removed at all joints. Steel tubing joints shall be made in accordance with the manufacturer's recommendations. Joints in steel tubing shall be painted with the same material as the baked-on coating within 8 hours after joints are made. Tubing shall be protected against oxidation during brazing by continuous purging of the inside of the piping using nitrogen. All piping shall be supported prior to brazing and shall not be sprung or forced.

3.1.2.2 Threaded Joints

Threaded joints shall be made with tapered threads and made tight with PTFE tape complying with ASTM D 3308 or equivalent thread-joint compound applied to the male threads only. Not more than three threads shall show after the joint is made.

3.1.2.3 Welded Joints

Welding shall be in accordance with qualified procedures using qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. Contracting Officer shall be notified 24 hours in advance of welding tests and the tests shall be performed at the work site if practical. A permanent mark shall be applied near each weld to identify the welder who made that weld.Structural members shall be welded in accordance with Section 05055 WELDING, STRUCTURAL. Welded joints in steel refrigerant piping shall be fusion-welded. Changes in direction of piping shall be made with welded fittings only; mitering or notching pipe or other similar construction to form elbows or tees will not be permitted. Branch connections shall be made with welding tees or forged welding branch outlets. Steel pipe shall be thoroughly cleaned of all scale and foreign matter before the piping is assembled. During welding the pipe and fittings shall be filled with an inert gas, such as nitrogen, to prevent the formation of scale. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and rewelded at no additional cost to the Government. Electrodes shall be stored and dried in accordance with AWS D1.1 or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.2.4 Flanged Joints

Flanged joints shall be faced true, provided with gaskets suitable for use with refrigerants and made square and tight. When steel refrigerant piping is used, union or flange joints shall be provided in each line immediately preceding the connection to each piece of equipment requiring maintenance, such as compressors, coils, chillers, control valves, and other similar items.

3.1.2.5 Flared Connections

When flared connections are used, a suitable lubricant shall be used between the back of the flare and the nut in order to

avoid tearing the flare while tightening the nut.

3.1.2.6 Thermometers

Thermometers shall be located specifically on, but not limited to the following: the sensing element of each automatic temperature control device where a thermometer is not an integral part thereof, the liquid line leaving receiver and the suction line at each evaporator or liquid cooler.

3.1.2.7 Supports

a. General: All refrigerant pipe supports shall be in accordance with ASME B31.5. Hangers used to support piping 50 mm (2 inches) and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement, when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers.

b. Seismic Requirements: All piping and attached valves shall be supported and braced to resist seismic loads as specified under Section 13080 SEISMIC PROTECTION FOR MECHANICAL, ELECTRICAL EQUIPMENT as shown on the drawings. Structural steel required for reinforcement to properly support piping, headers, and equipment but not shown shall be provided under this section. Material used for support shall be as specified under Section 05120 STRUCTURAL STEEL.

c. Structural Attachments: Structural steel brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material and installation shall be as specified under Section 05120 STRUCTURAL STEEL.

3.1.2.8 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein. Pipe hanger types 5, 12, and 26 shall not be used.

a. Hangers: Type 3 shall not be used on insulated piping.

b. Inserts: Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustments may be used if they otherwise meet the requirements for Type 18 inserts.

c. C-Clamps: Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

d. Angle Attachments: Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

e. Hangers: Type 24 may be used only on trapeze hanger systems or on fabricated frames.

f. Saddles and Shields: Where Type 39 saddle or Type 40 shield are permitted for a particular pipe attachment application, the Type 39 saddle, connected to the pipe, shall be used on all pipe 100 mm (4 inches) and larger when the temperature of the medium is 16 degrees C or higher. Type 40 shields shall be used on all piping less than 100 mm (4 inches) and all piping 100 mm (4 inches) and larger carrying medium less than 16 degrees C. A high density insulation insert of cellular glass shall be used under the Type 40 shield for piping 50 mm (2 inches) and larger.

g. Horizontal Pipe Supports: Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 300 mmfrom the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 mapart at valves. Pipe hanger loads suspended from steel joist with hanger loads between panel points in excess of 22 kg shall have the excess hanger loads suspended from panel points.

h. Vertical Pipe Supports: Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 4.5 m, not more than 2.4 m from end of risers, and at vent terminations.

i. Pipe Guides: Type 35 guides using, steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

j. Steel Slides: Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On piping 100 mm (4 inches) and larger, a Type 39 saddle shall be used. On piping under 100 mm (4 inches), a Type 40 protection shield may be attached to the pipe or insulation and freely rest on a steel slide plate.

k. High Temperature Guides with Cradles: Where there are high system temperatures and welding to piping is not desirable, then the Type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 100 mm, or by an amount adequate for the insulation, whichever is greater.

l. Multiple Pipe Runs: In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.1.2.9 Pipe Alignment Guides

Pipe alignment guides shall be provided where indicated for expansion loops, offsets, and bends and as recommended by the manufacturer for expansion joints, not to exceed 1.5 m on each side of each expansion joint, and in lines 100 mm (4 inches) or smaller not more than 600 mm on each side of the joint.

3.1.2.10 Anchors

Anchors shall be provided wherever necessary or indicated to localize expansion or to prevent undue strain on piping. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results using turnbuckles where required. Supports, anchors, or stays shall not be attached where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline. Detailed drawings of pipe anchors shall be submitted for approval before installation.

3.1.2.11 Pipe Sleeves

Sleeves shall not be installed in structural members except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Pipes passing through concrete or masonry wall or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Unless otherwise indicated, sleeves shall be of such size as to provide a minimum of 6 mm all-around clearance between bare pipe and sleeves or between jacketed-insulation and sleeves. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe or cast iron pipe. Sleeves in non-bearing walls, floors, or ceilings may be steel pipe, cast iron pipe, galvanized sheet metal with lock-type

longitudinal seam and of the metal thickness indicated, or moisture resistant fiber or plastic. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over-insulation and sleeve shall be sealed as indicated and specified in Section 07920 JOINT SEALING. Pipes passing through wall waterproofing membrane shall be sleeved as specified above, and a waterproofing clamping flange shall be installed.

a. Roof Sleeves:

For STANDING SEAM Metal Roof: Pipes passing through roof shall be installed through a preformed neoprene sleeve with hose clamp. The boot shall extend not less than 200 mm from the pipe. The neoprene sleeve shall extend up the pipe a minimum of 250 mm.

For MODIFIED BITUMEN Roof: Pipes passing through roof waterproofing membrane shall be installed through a 5.17 kg/sq. m. (17 ounce) copper sleeve, or a 0.81 mm (0.032 inch) thick aluminum sleeve, each within an integral skirt or flange. Flashing sleeve shall be suitably formed, and skirt or flange shall extend not less than 200 mm from the pipe and shall be set over the roof membrane in a troweled coating of bituminous cement. The flashing sleeve shall extend up the pipe a minimum of 50 mm above highest floor level of the roof or a minimum of 250 mm above the roof, whichever is greater, or 250 mm above the floor. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. Pipes up to and including 250 mm (10 inches)in diameter passing through roof waterproofing membrane may be installed through a sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess. In lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve or conduit and sleeve, a modular mechanical type sealing assembly may be installed. Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals shall provide sleeves of the proper diameters.

b. Fire-Rated Walls and Partitions: Penetration of fire-rated walls and partitions shall be sealed as specified in Section 07270 FIRESTOPPING.

3.1.2.12 Escutcheons

Finished surfaces where exposed piping, bare or insulated, pass through floors, walls, or ceilings, except in boiler, utility, or equipment rooms, shall be provided with escutcheons. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheon shall be secured to pipe or pipe covering.

3.1.2.13 Access Panels

Access panels shall be provided for all concealed valves, vents, controls, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METALS.

3.1.3 Water Piping

Pipe and fitting installation shall conform to the requirements of ASME B31.1. Pipe shall be cut accurately to

measurements established at the jobsite, and worked into place without springing or forcing, completely clearing all windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipe or tubing shall be cut square, shall have burrs removed by reaming, and shall permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers.

3.1.3.1 Directional Changes

Changes in direction shall be made with fittings, except that bending of pipe 100 mm (4 inches) and smaller will be permitted, provided a pipe bender is used and wide weep bends are formed. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted.

3.1.3.2 Functional Requirements

Horizontal supply mains shall pitch down in the direction of flow as indicated. The grade shall not be less than 2 mm in 1 m. Reducing fittings shall be used for changes in pipe sizes. Open ends of pipelines and equipment shall be capped or plugged during installation to keep dirt or other foreign materials out of the system. Pipe not otherwise specified shall be uncoated. Connections to appliances shall be made with malleable iron unions for steel pipe 65 mm (2-1/2 inches) or less in diameter, and with flanges for pipe 80 mm (3 inches) and above in diameter. Connections between ferrous and copper piping shall be electrically isolated from each other with dielectric unions or flanges. All piping located in air plenums shall conform to NFPA 90A requirements. Pipe and fittings installed in inaccessible conduits or trenches under concrete floor slabs shall be welded.

3.1.3.3 Valves

Isolation gate or ball valves shall be installed on each side of each piece of equipment, at the midpoint of all looped mains, and at any other points indicated or required for draining, isolating, or sectionalizing purpose. Isolation valves may be omitted where balancing cocks are installed to provide both balancing and isolation functions. Each valve except check valves shall be identified. Valves in horizontal lines shall be installed with stems horizontal or above.

3.1.3.4 Air Vents

Air vents shall be provided at all high points, on all water coils, and where indicated to ensure adequate venting of the piping system.

3.1.3.5 Drains

Drains shall be provided at all low points and where indicated to ensure complete drainage of the piping. Drains shall be accessible, and shall consist of nipples and caps or plugged tees unless otherwise indicated.

3.1.3.6 Flexible Pipe Connectors

Preinsulated flexible pipe connectors shall be attached to other components in strict accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the flexible pipe connector manufacturer and shall be provided at the intervals recommended.

3.1.3.7 Flanges and Unions

Except where copper tubing is used, union or flanged joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items.

3.1.3.8 Grooved Mechanical Joints

Grooves shall be prepared in accordance with the coupling manufacturer's instructions. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, or narrow-land micrometer. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances.

3.1.4 Refrigeration Piping

Unless otherwise specified, pipe and fittings installation shall conform to requirements of ASME B31.5. Pipe shall be cut accurately to measurement established at the jobsite and worked into place without springing or forcing. Cutting or otherwise weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipes shall be cut square, shall have burrs removed by reaming, and shall be installed in a manner to permit free expansion and contraction without damage to joints or hangers. Filings, dust, or dirt shall be wiped from interior of pipe before connections are made.

3.1.4.1 Directional Changes

Changes in direction shall be made with fittings, except that bending of pipe 100 mm (4 inches) and smaller will be permitted, provided a pipe bender is used and wide-sweep bends are formed. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, or other malformations will not be accepted.

3.1.4.2 Functional Requirements

All piping shall be installed 4 mm per m of pipe in the direction of flow to ensure adequate oil drainage. Open ends of refrigerant lines or equipment shall be properly capped or plugged during installation to keep moisture, dirt, or other foreign material out of the system. Piping shall remain capped until installation. Equipment piping shall be in accordance with the equipment manufacturer's recommendations and the contract drawings.

3.1.4.3 Valves

a. Stop valves shall be installed on each side of each piece of equipment such as compressors condensers, evaporators, receivers, and other similar items in multiple-unit installation, to provide partial system isolation as required for maintenance or repair. Angle and globe valves shall be installed with stems horizontal unless otherwise indicated. Ball valves shall be installed with stems positioned to facilitate operation and maintenance. All valves except check valves shall be identified with a brass or aluminum tag not less than 35 mm (1-3/8 inch) in diameter, correctly stamped to explain the valve function, and with a number for identification. Tags shall be secured to the valve with No. 12 AWG copper wire.

b. Expansion valves shall be installed with the thermostatic expansion valve bulb located on top of the suction line when the suction line is less than 54 mm (2-1/8 inches) in diameter and at the 4 o'clock or 8 o'clock position on lines larger than 54 mm (2-1/8 inches). The bulb shall be securely fastened with two clamps. The bulb shall be insulated. The bulb shall installed in a horizontal portion of the suction line, if possible, with the pigtail on the bottom. If the bulb must be installed in a vertical line, the bulb tubing shall be facing up.

3.1.4.4 Vibration Dampers

Vibration damper shall be provided in the suction and discharge lines on spring mounted compressors. Vibration dampers shall be installed parallel with the shaft of the compressor and shall be anchored firmly at the upstream end on the suction line and the downstream end in the discharge line.

3.1.4.5 Strainers

Strainers shall be provided immediately ahead of all solenoid valves and expansion devices. Strainers may be an integral part of the expansion valve.

3.1.4.6 Filter Dryer

A liquid line filter dryer shall be provided on each refrigerant circuit located such that all liquid refrigerant passes through a filter dryer. The filter dryer shall be sized in accordance with the manufacturer's recommendations for the system in which it is installed. The filter dryer shall be installed such that the filter dryer can be isolated from the system, the isolated portion of the system evacuated, and the filter dryer replaced. Filter dryers shall be installed in the horizontal position except replaceable core filter dryers may be installed in the vertical position with the access flange on the bottom.

3.1.4.7 Sight Glass

A moisture indicating sight glass shall be installed in all refrigerant circuits down stream of all filter dryers.

3.1.4.8 Discharge Line Oil Separator

Discharge line oil separator shall be provided in the discharge line from each compressor. Oil return line shall be connected to the compressor as recommended by the compressor manufacturer.

3.1.4.9 Accumulator

Accumulators shall be provided in the suction line to each compressor.

3.1.5 NOT USED

3.1.6 Field Applied Insulation

Field applied insulation other than that specified for water boxes and headers shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.7 Factory Applied Insulation

3.1.7.1 Refrigerant Suction Lines

Refrigerant suction lines between the cooler and each compressor shall be insulated with not less than 19 mm (3/4 inch)thick unicellular plastic foam.

3.1.7.2 Liquid Coolers

Liquid coolers (including chilled water headers or boxes), which may have factory or field applied insulation, shall be

insulated with unicellular plastic foam. Insulation shall be not less than 19 mm (3/4 inch) thick or have a maximum thermal conductivity of 1.59 W/((sq. m)(degree K)) (0.28 Btu/((hr.)(sq. ft.)(degree F.))). In lieu of the above insulation, a 50 mm thickness of urethane foam may be used. Urethane foam shall be completely covered and sealed with a sheet metal jacket not lighter than 1.0 mm (20 gauge). Insulation on heads of coolers shall be constructed to provide easy removal and replacement of heads without damage to the insulation.

3.2 TESTS

3.2.1 Field Tests

Tests shall be conducted in the presence of the Contracting Officer. Water and electricity required for the tests will be furnished by the Government. Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor. The services of a qualified technician shall be provided as required to perform all tests and procedures indicated herein. Field tests shall be coordinated with Section 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

3.2.1.1 Water Pipe Testing

After cleaning, water piping shall be hydrostatically tested at a pressure equal to 150 percent of the total system operating pressure for period of time sufficient to inspect every joint in the system and in no case less than 2 hours. Leaks shall be repaired and piping retested until test is successful. No loss of pressure shall be allowed. Leaks shall be repaired by rewelding or replacing pipe or fittings. Caulking of joints will not be permitted. Concealed and insulated piping shall be tested in place before concealing.

3.2.1.2 Refrigerant Pipe Testing

a. Refrigerant Leakage Test: After all components of the refrigerant system have been installed and the piping connected, the system shall be subjected to a refrigerant leakage test. The refrigerant leakage test shall be done with dry nitrogen before any refrigerant pipe is insulated or covered. High and low side of the refrigerant system shall be tested for the minimum refrigerant leakage test pressure specified in ASHRAE 15, for the refrigerant employed in the system. System shall be proved tight and free of leaks by allowing the refrigerant leakage test pressure to remain on the system for 24 hours with no drop in pressure. The initial test pressure and surrounding air temperature will be recorded. After the 24 hour hold period, the final system pressure and surrounding air temperature will be recorded. A correction of 3.7 kPa shall be allowed for each degree Cchange in the initial and final temperature of the surrounding air, plus for an increase and minus for a decrease. The system shall have passed the refrigerant leakage test if the corrected final system pressure is equal to the initial system test pressure. If the pressures are not equal, the leaks shall be located and repaired.

b. Refrigerant Leaks: To repair leaks, the joint shall be taken apart, thoroughly cleaned, and remade as a new joint. Joints repaired by caulking or remelting and adding more brazing material will not be acceptable. After leak repairs have been made, the refrigerant leakage test shall be conducted again.

c. Evacuation Test: After the foregoing tests have been satisfactorily completed and the pressure relieved, entire system shall be evacuated to an absolute pressure of 300 microns. During evacuation of the system, the ambient temperature shall be higher than 2 degrees C. Vacuum line shall be closed, and the system shall stand for 1 hour. After this period, the absolute pressure shall not exceed 500 microns. If the pressure rises over 500 microns, the system shall continue to be evacuated until the system reaches 300 microns and can stand for 1 hour with the vacuum line closed without the absolute pressure rising over 500 microns. During evacuation, pressures shall be recorded by a thermocouple type, electronic type, or a calibrated-micron type gauge.

3.2.2 System Performance Tests

After the foregoing tests have been completed and before each refrigeration system is accepted, tests to demonstrate the general operating characteristics of all equipment shall be conducted by a registered professional engineer or an approved manufacturer's startup representative experienced in system startup and testing, at such times as directed. Tests shall cover a period of not less than 3 days for each system and shall demonstrate that the entire system is functioning in accordance with the drawings and specifications. Corrections and adjustments shall be made as necessary and tests shall be re-conducted to demonstrate that the entire system is functioning as specified.

3.3 NOT USED

3.4 MANUFACTURER'S FIELD SERVICE

The services of a factory-trained representative shall be provided for 2 days. The representative shall advise on the following:

a. Hermetic machines:

(1) Testing hermetic water-chilling unit under pressure for refrigerant leaks; evacuation and dehydration of machine to an absolute pressure of not over 300 microns.

(2) Charging the machine with refrigerant.

(3) Starting the machine.

b. Open Machines:

(1) Erection, alignment, testing, and dehydrating.

(2) Charging the machine with refrigerant.

(3) Starting the machine.

3.5 CLEANING AND ADJUSTING

3.5.1 Piping

Pipes shall be cleaned free of scale and thoroughly flushed of all foreign matter. A temporary bypass shall be provided for all water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from all water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented.

3.5.2 Equipment

Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or

directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.6 DEMONSTRATIONS

Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total 8 hours of normal working time and start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations.

--END OF SECTION--

SECTION 15650

CENTRAL REFRIGERATED AIR-CONDITIONING SYSTEM

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SUBMITTAL REGISTER (ER415-1-10)	CONTRACT NO.

TITLE AND LOCATION	CONTRACTOR	SPEC. SECTION
Discom Barracks Complex, Phase I Ft. Campbell, Kentucky		15650

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-01 Data										
			Central Refrigerated Air-Conditioning System; GA.										
			Water Treatment Systems; GA.										
			Spare Parts; FIO.										
			Qualifications; FIO.										
			SD-04 Drawings										
			Central Refrigerated Air-Conditioning System ; GA.										
			SD-06 Instructions										
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			SD-07 Schedules										
			Tests; FIO.										
			Demonstrations; GA.										
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			Central Refrigerated Air-Conditioning System; GA.										
			SD-19 Operation and Maintenance Manuals										
			Operation Manual; GA.										
			Maintenance Manual; GA.										
			Water Treatment System; FIO.										

SAFETY PAYS

SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 350	(1986) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
ARI 410	(1991) Forced-Circulation Air-Cooling and Air-Heating Coils
ARI 430	(1989) Central-Station Air-Handling Units
ARI 440	(1989) Room Fan-Coil Air-Conditioners
ARI 445	(1987) Room Air-Induction Units
ARI 880	(1990) Air Terminals
ARI Guideline D	(1987) Application and Installation of Central Station Air-Handling Units

AIR CONDITIONING CONTRACTORS OF AMERICA (ACCA)

ACCA Manual 4	(1990) Installation Techniques for Perimeter Heating & Cooling

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 210	(1985) Laboratory Methods of Testing Fans for Rating
AMCA 300	(1994) Reverberant Room Method for Sound Testing of Fans

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABEMA)

ABEMA 9	(1990) Load Ratings and Fatigue Life for Ball Bearings
ABEMA 11	(1990) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S12.32	(1990) Precision Methods for the Determination of Sound Power Levels of Discrete Frequency and Narrow-Band Noise Sources in Reverberation Rooms

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1990) Ferritic Malleable Iron Castings
ASTM A 53	(1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 106	(1994) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 167	(1993) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 181	(1994) Forgings, Carbon Steel, for General-Purpose Piping
ASTM A 183	(1983; R 1990) Carbon Steel Track Bolts and Nuts
ASTM A 193	(1996) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 234	(1996) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 733	(1993) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A 924	(1994) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1993) Seamless Copper Tube
ASTM B 88	(1993a) Seamless Copper Water Tube
ASTM B 117	(1994) Operating Salt Spray (Fog) Testing Apparatus
ASTM B 650	(1993) Electrodeposited Engineering Chromium Coatings of Ferrous Substrates

ASTM C 916	(1985; Rev 1990) Adhesives for Duct Thermal Insulation
ASTM C 1071	(1991) Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)
ASTM D 520	(1984; R 1989) Zinc Dust Pigment
ASTM D 1384	(1993) Corrosion Test for Engine Coolants in Glassware
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 1785	(1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2000	(1990; R 1994) Rubber Products in Automotive Applications
ASTM D 2466	(1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2855	(1993) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3359	(1995) Measuring Adhesion by Tape Test
ASTM E 84	(1994) Surface Burning Characteristics of Building Materials
ASTM E 437	(1992) Industrial Wire Cloth and Screens (Square Opening Series)
ASTM F 872	(1984; R 1990) Filter Units, Air-Conditioning: Viscous-Impingement Type, Cleanable
ASTM F 1199	(1988; R 1993) Cast (All Temperature and Pressures) and Welded Pipe Line Strainers (150 psig and 150 degrees F Maximum)
ASTM F 1200	(1988; R 1993) Fabricated (Welded) Pipe Line Strainers (Above 150 psig and 150 degrees F)

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 15	(1994) Safety Code for Mechanical Refrigeration
ASHRAE 52.1	(1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for

	Removing Particulate Matter
ASHRAE 68	(1986) Laboratory Method of Testing In-Duct Sound Power Measurement Procedures for Fans
ASHRAE 70	(1991) Method of Testing Rating the Performance of Air Outlets and Inlets
ASHRAE 84	(1991) Method of Testing Air-to-Air Heat Exchangers

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.5	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(1986; R 1994) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B31.1	(1995) Power Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV IX	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606	(1987) Grooved and Shouldered Joints

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1994) Structural Welding Code - Steel

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1419	(Rev D) Filter Element, Air Conditioning (Viscous-Impingement and Dry Types, Replaceable)

EXPANSION JOINT MANUFACTURERS ASSOCIATION (EJMA)

EJMA-01	(1993) EJMA Standards

INSTITUTE OF ENVIRONMENTAL SCIENCES (IES)

IES RP-CC-001.3	(1993) HEPA and ULPA Filters

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1990) Cast Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-72	(1992) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
MSS SP-110	(1992) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1993; Rev 1-1993; Rev 2-1995) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996) National Electrical Code
NFPA 90A	(1996) Installation of Air Conditioning and Ventilating

	Systems
NFPA 96	(1994) Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment

NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION (NAIMA)

NAIMA-AH116	(1993) Fibrous Glass Duct Construction Standards

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION(SMACNA)

SMACNA-01	(1975) Accepted Industry Practice for Industrial Duct Construction
SMACNA-05	(1992) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
SMACNA-06	(1985) HVAC Duct Construction Standards - Metal and Flexible
SMACNA-10	(1985) HVAC Air Duct Leakage Test Manual

UNDERWRITERS LABORATORIES (UL)

UL-01	(1995; Supple) Building Materials Directory
UL-03	(1995) Electrical Construction Materials Directory
UL-05	(1995; Supple) Fire Resistance Directory
UL 94	(1991; Rev thru Apr 1995) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 181	(1994; Rev Sep 95) Factory-Made Air Ducts and Air Connectors
UL 214	(1993) Tests for Flame-Propagation of Fabrics and Films
UL 555	(1995) Fire Dampers
UL 586	(1990; Rev Apr 1995) High-Efficiency, Particulate, Air Filter Units
UL 705	(1994; Rev thru Apr 1995) Power Ventilators
UL 723	(1993; Rev Apr 1994) Test for Surface Burning Characteristics of Building Materials
UL 900	(1994) Test Performance of Air Filter Units

UL 1995 (1990) Heating and Cooling Equipment

1.2 COORDINATION OF TRADES

Ductwork, piping offsets, fittings, and accessories shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Components and Equipment Data; GA.

Manufacturer's catalog data shall be included with the detail drawings for the following items. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with contract requirements for the following:

a. Piping Components

b. Ductwork Components

c. Air Systems Equipment

d. Air Handling Units

e. Terminal Units

SD-04 Drawings

Air Supply, Distribution, Ventilation, and Exhaust Equipment; GA.

Drawings shall consist of equipment layout including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of all guides and anchors, the load imposed on each support or anchor, and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

SD-06 Instructions

Test Procedures; FIO.

Proposed test procedures for piping hydrostatic test, ductwork leak test, and performance tests of systems, at least 2 weeks prior to the start of related testing.

Welding Procedures; FIO.

A copy of qualified welding procedures, at least 2 weeks prior to the start of welding operations.

System Diagrams; GA.

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

SD-07 Schedules

Test Schedules; FIO.

Proposed test schedules for hydrostatic test of piping, ductwork leak test, and performance tests, at least 2 weeks prior to the start of related testing.

Field Training Schedule; FIO.

Proposed schedule for field training, at least 2 weeks prior to the start of related training.

SD-08 Statements

Similar Services; FIO.

Statement demonstrating successful completion of similar services on at least 5 projects of similar size and scope, at least 2 weeks prior to submittal of other items required by this section.

Welding Qualification; FIO.

A list of names and identification symbols of qualified welders and welding operators, at least 2 weeks prior to the start of welding operations.

SD-09 Reports

Test Reports; FIO.

Test reports for the piping hydrostatic test, ductwork leak test, and performance tests in booklet form, upon completion of testing. Reports shall document phases of tests performed including initial test summary, repairs/adjustments made, and final test results.

SD-13 Certificates

Bolts; FIO.

Written certification from the bolt manufacturer that the bolts furnished comply with the requirements of this

specification. The certification shall include illustrations of product markings, and the number of each type of bolt to be furnished.

SD-19 Operation and Maintenance Manuals

Air Supply, Distribution, Ventilation, and Exhaust Manuals; GA.

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Components and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year experience shall include applications of components and equipment under similar circumstances and of similar size. The 2 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization.

2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

2.3 NAMEPLATES

Equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.4 EQUIPMENT GUARDS AND ACCESS

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded according to OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

2.5 PIPING COMPONENTS

Piping, valves, fittings and accessories shall be as specified in Section 15569, WATER HEATING; GAS; UP TO 20 MBTUH, for heating water piping and dual temperature water piping, and Section 15650, CENTRAL REFRIGERATED AIR-CONDITIONING SYSTEM for chilled water piping and refrigerant piping.

2.6 ELECTRICAL WORK

Electrical motor-driven equipment specified shall be provided complete with motor, motor starter, and controls. Unless otherwise specified, electric equipment, including wiring and motor efficiencies, shall be according to Section 16415 ELECTRICAL WORK, INTERIOR. Electrical characteristics and enclosure type shall be as shown. Unless otherwise indicated, motors of 745 W and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary. Each motor shall be according to NEMA MG 1 and shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices, but not shown, shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controller may be provided to accomplish the same function. Solid-state variable-speed controllers shall be utilized for motors rated 7.45 kW (10 hp) or less. Adjustable frequency drives shall be used for larger motors.

2.7 CONTROLS

Controls shall be provided as specified in Section 15950 HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS.

2.8 DUCTWORK COMPONENTS

2.8.1 Metal Ductwork

All aspects of metal ductwork construction, including all fittings and components, shall comply with SMACNA-06 unless otherwise specified. Elbows shall be radius type with a centerline radius of 1-1/2 times the width or diameter of the duct where shown. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure Class 125, 250, and 500 Pa (1/2, 1, and 2 inch w.g.) ductwork shall meet the requirements of Seal Class C. Class 750 through 2500 Pa (3 through 10 inch) shall meet the requirements of Seal Class A. Sealants shall conform to fire hazard classification specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA-06. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 50 mmband width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable. Outdoor air intake ducts and plenums shall be fabricated with watertight soldered or brazed joints and seams.

2.8.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for converging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

2.8.1.2 NOT USED

2.8.1.3 Insulated Nonmetallic Flexible Duct Runouts

Flexible duct runouts shall be used only between supply branch ducts and supply diffusers. Runout length shall in no case exceed 3 m. Runouts shall be preinsulated, factory fabricated, and shall comply with NFPA 90A and UL 181. Either field or factory applied vapor barrier shall be provided. Insulated flexible connectors may be used as runouts.

The insulated material and vapor barrier shall conform to the requirements of Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. The insulation material surface shall not be exposed to the air stream.

2.8.1.4 General Service Duct Connectors

A flexible duct connector approximately 150 mm in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL-01.

2.8.2 NOT USED

2.8.3 Ductwork Accessories

2.8.3.1 Duct Access Doors

Access doors shall be provided in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA-06. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 375 by 450 mm, unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 600 by 600 mm or larger shall be provided with fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

2.8.3.2 Fire Dampers

Fire dampers shall be 1-1/2 hour fire rated unless otherwise indicated. Fire dampers shall conform to the requirements of NFPA 90A and UL 555. Fire dampers shall be automatic operating type and shall have a dynamic rating suitable for the maximum air velocity and pressure differential to which it will be subjected. Fire dampers shall be approved for the specific application, and shall be installed according to their listing. Fire dampers shall be equipped with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, will not impair the operation of the damper. Sleeves or frames shall be equipped with perimeter mounting angles attached on both sides of the wall or floor opening. Ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce the ceiling of the assemblies shall be constructed in conformance with UL-05. Fire dampers shall be curtain type with damper blades out of the air stream. Dampers shall not reduce the duct or the air transfer opening cross-sectional area. Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness. Unless otherwise indicated, the installation details given in SMACNA-05 and in manufacturer's instructions for fire dampers shall be followed.

2.8.3.3 Splitters and Manual Balancing Dampers

Splitters and manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portions of the building, operators shall be chromium plated with all exposed edges rounded. Splitters shall be operated by quadrant operators or 5 mm (3/16 inch) rod brought through the side of the duct with locking setscrew and bushing. Two rods are required on splitters over 200 mm (8 inches). Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be 2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 300 mm. Access doors or panels shall be provided for all concealed damper operators and locking setscrews. Unless

otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operator not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

2.8.3.4 Air Deflectors and Branch Connections

Air deflectors shall be provided at duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. Conical branch connections or 45 degree entry connections may be used in lieu of deflectors or extractors for branch connections. All air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external adjustments shall be provided with stand-off mounting brackets, integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be provided on insulated ducts and are described herein. Fixed air deflectors, also called turning vanes, shall be provided in 90 degree elbows.

2.8.4 Duct Sleeves, Framed Prepared Openings, Closure Collars

2.8.4.1 Duct Sleeves

Duct sleeves shall be provided for round ducts 375 mm in diameter or less passing through floors, walls, ceilings, or roof, and installed during construction of the floor, wall, ceiling, or roof. Round ducts larger than 375 mm in diameter and square, rectangular, and oval ducts passing through floors, walls, ceilings, or roof shall be installed through framed prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Framed prepared openings shall be fabricated from 1.0 mm (20 gauge) galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, ASTM A 53, Schedule 20 shall be used. Sleeve shall provide 25 mm clearance between the duct and the sleeve or 25 mm clearance between the insulation and the sleeve for insulated ducts.

2.8.4.2 Framed Prepared Openings

Openings shall have 25 mm clearance between the duct and the opening or 25 mm clearance between the insulation and the opening for insulated ducts.

2.8.4.3 Closure Collars

Collars shall be fabricated of galvanized sheet metal not less than 100 mm wide, unless otherwise indicated, and shall be installed on exposed ducts on each side of walls or floors where sleeves or prepared openings are provided. Collars shall be installed tight against surfaces. Collars shall fit snugly around the duct or insulation. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier. Collars for round ducts 375 mm in diameter or less shall be fabricated from 1.0 mm (20 gauge) galvanized steel. Collars for round ducts larger than 375 mm and square, and rectangular ducts shall be fabricated from 1.3 mm (18 gauge) galvanized steel. Collars shall be installed with fasteners on maximum 150 mm centers, except that not less than

4 fasteners shall be used.

2.8.5 NOT USED

2.8.6 NOT USED

2.8.7 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 0.25 m/s (50 fpm) in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified according to ASHRAE 70. Inlets and outlets shall be sound rated and certified according to ASHRAE 70. Sound power level shall be as indicated. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers. Linear slot diffusers shall be provided with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 2 m above the floor, they shall be protected by a grille or screen according to NFPA 90A.

2.8.7.1 Diffusers

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors of the type indicated. Air handling troffers or combination light and ceiling diffusers shall conform to the requirements of UL-03 for the interchangeable use as cooled or heated air supply diffusers or return air units. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Return or exhaust units shall be similar to supply diffusers.

2.8.7.2 Registers and Grilles

Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply registers shall be installed at least 150 mm below the ceiling unless otherwise indicated. Return and exhaust registers shall be located 150 mm above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

2.8.8 Louvers

Louvers for installation in exterior walls which are associated with the air supply and distribution system shall be as specified in Section 07600 SHEET METALWORK, GENERAL.

2.8.9 Air Vents, Penthouses, and Goosenecks

Air vents, penthouses, and goosenecks shall be fabricated from galvanized steel or aluminum sheets with galvanized or aluminum structural shapes. Sheet metal thickness, reinforcement, and fabrication shall conform to SMACNA-06. Louver blades shall be accurately fitted and secured to frames. Edges of louver blades shall be folded or beaded for rigidity and baffled to exclude driving rain. Air vents, penthouses, and goosenecks shall be provided with bird screen.

2.8.10 Bird Screens and Frames

Bird screens shall conform to ASTM E 437, Type I, Class 1, 2 by 2 mesh, 1.6 mmdiameter aluminum wire or 0.8 mminch diameter stainless steel wire. Frames shall be removable type or stainless steel or extruded aluminum.

2.9 AIR SYSTEMS EQUIPMENT

2.9.1 Fans

Fans shall be tested and rated according to AMCA 210. Fans may be connected to the motors either directly or indirectly with V-belt drive. V-belt drives shall be designed for not less than 120 percent of the connected driving capacity. Motor sheaves shall be variable pitch for 11 kW (15 hp) and below and fixed pitch as defined by ARI Guideline D. Variable pitch sheaves shall be selected to drive the fan at a speed which will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, a replaceable sheave shall be provided when needed to achieve system air balance. Motors for V-belt drives shall be provided with adjustable rails or bases. Removable metal guards shall be provided for all exposed V-belt drives, and speed-test openings shall be provided at the center of all rotating shafts. Fans shall be provided with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Fan and motor assemblies shall be provided with vibration-isolation supports or mountings as indicated. Vibration-isolation units shall be standard products with published loading ratings. Each fan shall be selected to produce the capacity required at the fan static pressure indicated. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated.

2.9.1.1 Centrifugal Fans

Centrifugal fans shall be fully enclosed, single-width single-inlet, or double-width double-inlet, AMCA Pressure Class I, II, or III as required or indicated for the design system pressure. Impeller wheels shall be rigidly constructed, accurately balanced both statically and dynamically. Fan blades may be forward curved, backward-inclined or airfoil design in wheel sizes up to 750 mm (30 inches). Fan blades for wheels over 750 mm (30 inches) in diameter shall be backward-inclined or airfoil design. Fan wheels over 900 mm (36 inches) in diameter shall have overhung pulleys and a bearing on each side of the wheel. Fan wheels 900 mm (36 inches) or less in diameter may have one or more extra long bearings between the fan wheel and the drive. Bearings shall be sleeve type, self-aligning and self-oiling with oil reservoirs, or precision self-aligning roller or ball-type with accessible grease fittings or permanently lubricated type. Grease fittings shall be connected to tubing and serviceable from a single accessible point. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABEMA 9 and ABEMA 11. Fan shafts shall be steel, accurately finished, and shall be provided with key seats and keys for impeller hubs and fan pulleys. Each fan outlet shall be of ample proportions and shall be designed for the attachment of angles and bolts for attaching flexible connections. Motors, unless otherwise indicated, shall not exceed 1800 rpm and shall have open enclosures. Motor starters shall be magnetic across-the-line type with general-purpose enclosure

2.9.1.2 In-Line Centrifugal Fans

In-line fans shall have centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Fans shall be mounted in a welded tubular casing. Air shall enter and leave the fan axially. Inlets shall be streamlined with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Fan bearings and drive shafts shall be enclosed and isolated from the air stream. Fan bearings shall be sealed against dust and dirt and shall be permanently lubricated, and shall be precision self aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABEMA 9 and ABEMA 11. Motors shall have open enclosure. Motor starters shall be magnetic across-the-line with general-purpose enclosures.Remote manual switch with

pilot indicating light shall be provided where indicated.

2.9.1.3 NOT USED

2.9.1.4 NOT USED

2.9.1.5 Centrifugal Type Power Wall Ventilators

Fans shall be direct or V-belt driven centrifugal type with backward inclined, non-overloading wheel. Motor housing shall be removable and weatherproof. Unit housing shall be designed for sealing to building surface and for discharge and condensate drippage away from building surface. Housing shall be constructed of heavy gauge aluminum. Unit shall be fitted with an aluminum or plated steel wire discharge bird screen,stainless steel wall grille,manufacturer's standard motor-operated damper,an airtight and liquid-tight metallic wall sleeve. Motor enclosure shall be totally enclosed fan cooled type. Lubricated bearings shall be provided.

2.9.1.6 Centrifugal Type Power Roof Ventilators

Fans shall be direct or V-belt driven with backward inclined, non-overloading wheel. Motor compartment housing shall be hinged or removable and weatherproof, constructed of heavy gauge aluminum. Fans shall be provided with birdscreen, disconnect switch,motorized dampers,roof curb,and extended base. Motors enclosure shall be dripproof type. Lubricated bearings shall be provided.

2.9.1.7 NOT USED

2.9.1.8 NOT USED

2.9.1.9 Ceiling Exhaust Fans

Suspended cabinet-type ceiling exhaust fans shall be centrifugal type, direct-driven. Fans shall have acoustically insulated housing. Integral backdraft damper shall be chatter-proof. The integral face grille shall be of egg-crate design or louver design. Fan motors shall be mounted on vibration isolators. Unit shall be provided with mounting flange for hanging unit from above. Fans shall be U.L. listed.

2.9.2 Coils

Coils shall be fin-and-tube type constructed of seamless copper or red brass tubes and aluminum or copper fins mechanically bonded or soldered to the tubes. Copper tube wall thickness shall be a minimum of 0.508 mm (0.020 inches). Red brass tube wall thickness shall be a minimum of 1.24 mm (0.049 inches). Aluminum fins shall be 0.19 mm (0.0075 inch) minimum thickness. Copper fins shall be 0.114 mm (0.0045 inch) minimum thickness. Casing and tube support sheets shall be not lighter than 1.6 mm (16 gauge) galvanized steel, formed to provide structural strength. When required, multiple tube supports shall be provided to prevent tube sag. Each coil shall be tested at the factory under water at not less than 2.76 MPa (400 psi) air pressure and shall be suitable for 1.38 MPa (200 psi) working pressure. Coils shall be mounted for counterflow service. Coils shall be rated and certified according to ARI 410.

2.9.2.1 Direct-Expansion Coils

Direct-expansion coils shall be suitable for the refrigerant involved. Suction headers shall be seamless copper tubing or seamless or resistance welded steel tube with copper connections. Supply headers shall consist of a distributor which shall distribute the refrigerant through seamless copper tubing equally to all circuits in the coil. Tubes shall be circuited to ensure minimum pressure drop and maximum heat transfer. Circuiting shall permit refrigerant flow from inlet to

suction outlet without causing oil slugging or restricting refrigerant flow in coil. Each coil to be field installed shall be completely dehydrated and sealed at the factory upon completion of pressure tests.

2.9.2.2 Water Coils

Water coils shall be installed with a pitch of not less than 10 mm per meter of the tube length toward the drain end. Headers shall be constructed of cast iron, welded steel or copper. Each coil shall be provided with a plugged vent and drain connection extending through the unit casing.

2.9.2.3 NOT USED

2.9.2.4 NOT USED

2.9.3 Air Filters

Air filters shall be listed according to requirements of UL 900, except high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test method shall be as listed under the Label Service and shall meet the requirements of UL 586.

2.9.3.1 Extended Surface Pleated Panel Filters

Filters shall be 50 mm (2 inch) depth, sectional, disposable type of the size indicated and shall have an average efficiency of 25 to 30 percent when tested according to ASHRAE 52.1. Initial resistance at 2.54 m/s (500 feet per minute) shall not exceed 9 mm water gauge. Filters shall be UL Class 2. Media shall be nonwoven cotton and synthetic fiber mat. A wire support grid bonded to the media shall be attached to a moisture resistant fiberboard frame. All four edges of the filter media shall be bonded to the inside of the frame to prevent air bypass and increase rigidity.

2.9.3.2 through 2.9.3.8 NOT USED

2.9.3.9 Holding Frames

Frames shall be fabricated from not lighter than 1.6 mm (16 gauge) sheet steel with rust-inhibitor coating. Each holding frame shall be equipped with suitable filter holding devices. Holding frame seats shall be gasketed. All joints shall be airtight.

2.9.3.10 Filter Gauges

Filter gauges shall be dial type, diaphragm actuated draft and shall be provided for all filter stations, including those filters which are furnished as integral parts of factory fabricated air handling units. Gauges shall be at least 98 mm (3-7/8 inches) in diameter, shall have white dials with black figures, and shall be graduated in 0.25 mm (0.01 inch), and shall have a minimum range of 25 mm beyond the specified final resistance for the filter bank on which each gauge is applied. Each gauge shall incorporate a screw operated zero adjustment and shall be furnished complete with two static pressure tips with integral compression fittings, two molded plastic vent valves, two 1.5 m (5 foot) minimum lengths of 6.35 mm (1/4 inch) diameter aluminum or vinyl tubing, and all hardware and accessories for gauge mounting.

2.10 AIR HANDLING UNITS

2.10.1 NOT USED

2.10.2 Factory-Fabricated Air Handling Units

Units shall be single-zone draw-through type or blow-through double-deck type as indicated. Units shall include fans, coils, airtight insulated casing, adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, combination sectional filter-mixing box,vibration-isolators, and appurtenances required for specified operation. Vibration isolators shall be as indicated. Each air handling unit shall have physical dimensions suitable to fit space allotted to the unit and shall have the capacity indicated. Air handling unit shall have published ratings based on tests performed according to ARI 430.

2.10.2.1 Casings

Casing sections shall be 2 inch double wall type constructed of a minimum 18 gauge galvanized steel. Inner casing of double-wall units shall be minimum 1.0 mm (20 gauge) solid galvanized steel. Casing shall be designed and constructed with an integral structural steel frame such that exterior panels are non-load bearing. Exterior panels shall be individually removable. Removal shall not affect the structural integrity of the unit. Casings shall be provided with inspection doors, access sections, and access doors as indicated. Inspection and access doors shall be insulated, fully gasketed, double-wall type, of a minimum 1.3 mm (18 gauge) outer and 1.0 mm (20 gauge) inner panels. Doors shall be rigid and provided with heavy duty hinges and latches. Inspection doors shall be a minimum 300 mm wide by 300 mm high. Access doors shall be minimum 600 mm wide and shall be the full height of the unit casing or a minimum of 1800 mm, whichever is less. Access Sections shall be according to paragraph AIR HANDLING UNITS. Drain pan shall be double-bottom type constructed of 16 gauge galvanized steel, pitched to the drain connection. Drain pans shall be constructed water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Intermediate drain pans or condensate collection channels and downspouts shall be provided, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Each casing section handling conditioned air shall be insulated with not less than 25 mm (1 inch) thick, 24 kg per cubic meter (1-1/2 pound density) coated fibrous glass material having a thermal conductivity not greater than 0.033 W/m-K (0.23 Btu/hr-sf-F). Factory applied fibrous glass insulation shall conform to ASTM C 1071, except that the minimum thickness and density requirements do not apply, and shall meet the requirements of NFPA 90A. Foam-type insulation is not acceptable. Foil-faced insulation shall not be an acceptable substitute for use on double-wall access doors and inspections doors and casing sections. Duct liner material, coating, and adhesive shall conform to fire-hazard requirements specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Exposed insulation edges and joints where insulation panels are butted together shall be protected with a metal nosing strip or shall be coated to conform to meet erosion resistance requirements of ASTM C 1071. A latched and hinged inspection door, shall be provided in the fan and coil sections. Additional inspection doors, access doors and access sections shall be provided where indicated.

2.10.2.2 Heating and Cooling Coils

Coils shall be provided as specified in paragraph AIR SYSTEMS EQUIPMENT, for types indicated.

2.10.2.3 NOT USED

2.10.2.4 Air Filters

Air filters shall be as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.10.2.5 Fans

Fans shall be double-inlet, centrifugal type with each fan in a separate scroll. Fans and shafts shall be dynamically balanced prior to installation into air handling unit, then the entire fan assembly shall be statically and dynamically balanced at the factory after it has been installed in the air handling unit. Fans shall be mounted on steel shafts accurately ground and finished. Fan bearings shall be sealed against dust and dirt and shall be precision self-aligning

ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABEMA 9 and ABEMA 11. Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Bearings shall be supported by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Bearings may not be fastened directly to the unit sheet metal casing. Fans and scrolls shall be furnished with coating indicated. Fans shall be driven by a unit-mounted or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Belt guards shall be the three sided enclosed type with solid or expanded metal face. Belt drives shall be designed for not less than a 1.3 service factor based on motor nameplate rating. Motor sheaves shall be variable pitch for 20 kW and below and fixed pitch above 20 kW as defined by ARI Guideline D. Where fixed sheaves are required, variable pitch sheaves may be used during air balance, but shall be replaced with an appropriate fixed sheave after air balance is completed. Variable pitch sheaves shall be selected to drive the fan at a speed that will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. Motors for V-belt drives shall be provided with adjustable bases. Fan motors shall have open enclosures. Motor starters shall be magnetic across-the-line type with general-purpose enclosure. Unit fan or fans shall be selected to produce the required capacity at the fan static pressure. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300 or ASHRAE 68.

2.10.2.6 Access Sections and Filter/Mixing Boxes

Access sections shall be provided where indicated and shall be furnished with access doors as shown. Access sections and filter/mixing boxes shall be constructed in a manner identical to the remainder of the unit casing and shall be equipped with access doors. Mixing boxes shall be designed to minimize air stratification and to promote thorough mixing of the air streams.

2.10.2.7 Diffuser Sections

Diffuser sections shall be furnished between the discharge of all supply fans and cooling coils of blow-through single zone units. Diffuser sections shall be fabricated by the unit manufacturer in a manner identical to the remainder of the unit casing, shall be designed to be airtight under positive static pressures up to 2 kPa (8 inches water gauge) and shall have an access door on each side for inspection purposes. Diffuser section shall contain a perforated diffusion plate, fabricated of galvanized steel, Type 316 stainless steel, aluminum, or steel treated for corrosion with manufacturer's standard corrosion-resisting finish. The diffusion plate shall be designed to accomplish uniform air flow across the down-stream coil while reducing the higher fan outlet velocity to within plus or minus 5 percent of the required face velocity of the downstream component.

2.10.2.8 Dampers

Dampers shall be as specified in Section 15950 HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS.

2.11 TERMINAL UNITS

2.11.1 Room Fan-Coil Units

Base units shall include galvanized coil casing, coil assembly drain pan, outside air damper, wall intake box, air filter, fans, motor, fan drive, and motor switch, plus an enclosure for cabinet models. Leveling devices integral with the unit shall be provided for vertical type units. Sound power levels shall be as indicated. Sound power level data or values for these units shall be obtained according to test procedures based on ARI 350. Sound power values apply to units provided with factory fabricated cabinet enclosures and standard grilles. Values obtained for the standard cabinet models will be acceptable for concealed models without separate test provided there is no variation between models as to the coil configuration, blowers, motor speeds, or relative arrangement of parts. Controls shall be provided as

specified in paragraph CONTROLS. Each unit shall be fastened securely to the building structure. Capacity of the units shall be as indicated. Room fan-coil units shall be certified as complying with ARI 440, and shall meet the requirements of UL 1995.

2.11.1.1 Enclosures

Enclosures shall be fabricated of not lighter than 1.3 mm (18 gauge) steel, reinforced and braced. Front panels of enclosures shall be removable and provided with 13 mm (1/2 inch) thick dual density fibrous glass insulation. The exposed side shall be high density, erosion-proof material suitable for use in air streams with velocities up to 23 m/s (4,500 fpm). Discharge grille shall be adjustable or integrally stamped and shall be of such design as to properly distribute air throughout the conditioned space. Plastic discharge and return grilles are acceptable provided the plastic material is certified by the manufacturer to be classified as flame resistant according to UL 94 and the material shall comply with the heat deflection criteria specified in UL 1995. Ferrous metal surfaces shall be galvanized or factory finished with corrosion resistant enamel. Access doors or removable panels shall be provided for piping and control compartments. Duct discharge collar shall be provided for concealed models. Enclosures shall have easy access for filter replacement.

2.11.1.2 Fans

Fans shall be galvanized steel or aluminum, multiblade, centrifugal type. In lieu of metal, fans and scrolls may be non-metallic materials of suitably reinforced compounds. Fans shall be dynamically and statically balanced. Surfaces shall be smooth. Assemblies shall be accessible for maintenance. Disassembly and re-assembly shall be by means of mechanical fastening devices and not by epoxies or cements.

2.11.1.3 Coils

Coils shall be constructed of not less than 10 mm (3/8 inch) outside diameter seamless copper tubing, with copper or aluminum fins mechanically bonded or soldered to the tubes. Coils shall be provided with not less than 12 mm (1/2 inch) outside diameter flare or sweat connectors, accessory piping package with thermal connections suitable for connection to the type of control valve supplied, and manual air vent. Coils shall be tested hydrostatically at 2000 kPa (300 psi) or under water at 1700 kPa (250 psi) air pressure and suitable for 1400 kPa (200 psi) working pressure. Provisions shall be made for coil removal.

2.11.1.4 Drain Pans

Drain and drip pans shall be sized and located to collect all water condensed on and dripping from any item within the unit enclosure or casing. Drain pans shall be constructed of not lighter than 0.9 mm (21 gauge) steel, galvanized after fabrication, thermally insulated to prevent condensation. Insulation shall have a flame spread rating not over 25 without evidence of continued progressive combustion, a smoke developed rating no higher than 50, and shall be of a waterproof type or coated with a waterproofing material. In lieu of the above, drain pans may be constructed of die-formed 0.85 mm (22 gauge) steel, formed from a single sheet, galvanized after fabrication, insulated and coated as specified for the 0.9 mm (21 gauge) material or of die-formed 0.9 mm (21 gauge) type 304 stainless steel, insulated as specified above. Drain pans shall be pitched to drain. Minimum 20 mm (3/4 inch) NPT or 15 mm (5/8 inch) OD drain connection shall be provided in drain pan. Auxiliary drain pans to catch drips from control and piping packages, eliminating insulation of the packages, may be plastic; if metal, the auxiliary pans shall comply with the requirements specified above. Insulation at control and piping connections thereto shall extend 25 mm minimum over the auxiliary drain pan.

2.11.1.5 Manually Operated Outside Air Dampers

Manually operated outside air dampers shall be provided according to the arrangement indicated. Dampers shall be

parallel airfoil type and of galvanized construction. Blades shall rotate on stainless steel or nylon sleeve bearings.

2.11.1.6 Filters

Filters shall be of the fiberglass disposable type, 25 mm (1 inch) thick, conforming to CID A-A-1419. Filters in each unit shall be removable without the use of tools.

2.11.1.7 Motors

Motors shall be of the permanent split-capacitor type with built-in thermal overload protection, directly connected to unit fans. Motor switch shall be two or three speeds and off, manually operated, and shall be mounted on an identified plate inside the unit below or behind an access door or adjacent to the room thermostat as indicated. In lieu of the above fan speed control, a solid-state variable-speed controller having a minimum speed reduction of 50 percent may be provided. Motors shall have permanently-lubricated or oilable sleeve-type or combination ball and sleeve-type bearings with vibration isolating mountings suitable for continuous duty. Motor power consumption, shown in watts, at the fan operating speed selected to meet the specified capacity shall not exceed the following values:

Unit Capacity (L/s)	Maximum Power Consumption (Watts)
94	55
142	60
189	65
283	80
378	130
472	130
566	130

2.11.2 Factory-Fabricated Fan Coil Units

Units shall be draw-through single zone type suitable for suspended installation, fabricated of galvanized steel with interior thermal insulation. Units shall be complete with two or three speed direct drive fan motor, direct expansion cooling coil with draw pan, hydronic heating coil, wiring and controls, and two inch thick extended surface pleated filter.

2.12 ELECTRIC UNIT HEATERS (HORIZONTAL PROPELLER FAN TYPE)

2.12.1 Construction

Unit heaters shall have input wattage, voltage, phase, output wattage (Btu/hr output), liters per second (LPs) (cubic feet per minute (cfm)) air delivery, number of steps, and mounting height as shown or as specified. Complete unit heater assembly shall comply with the requirements of UL 1025 and the requirements specified. Each unit heater shall be provided with terminals for control circuits and a single source of power as necessary. Control transformers, where required, shall be factory installed and of adequate capacity. Electrical load for three phase heaters shall be balanced between phases. Maximum discharge air temperature shall not exceed 60 degrees C (140 degrees F) when inlet air temperature is 16 degrees C (60 degrees F).

2.12.2 Heating Elements

Heating elements shall consist of nickel-chromium heating wire embedded in magnesium-oxide insulating refractory and sealed in corrosion-resisting metallic sheath with fins. The ends of elements shall be sealed and enclosed in terminal

box, and element sheath shall be mechanically pressed after filling to ensure maximum magnesium oxide compaction. Sheath and fins shall be cast aluminum or steel with fins brazed to sheath. Castings shall be free from defects of any nature. Steel sheath and fins shall be corrosion protected by copper plating. Heat tranbetween sheath and fins shall be uniform. Fins shall be spaced a maximum of six per 25.4 mm (1 inch) and fin surface temperature at any point shall not exceed 288 degrees C (550 degrees F) during normal operation. Elements shall be free from expansion noise and 60-cycle hum.

2.12.3 Enclosure

Heater fan, motor, and auxiliaries shall be contained in a housing. All metal surfaces of housing shall be not less than 1.2 mm (18 US gauge). Housings shall have the manufacturer's standard factory baked enamel finish. All parts shall be rigidly braced with heavy steel plates or structural steel shapes to prevent vibration and maintain alignment. Housing design shall provide ready access to interior parts without unfastening housing from mounting bracket. Swivel mounting brackets shall be furnished with each heater for wall or ceiling mounting as indicated. Each unit heater shall develop the floor area coverage and air throw required by the heater layout shown. The floor area coverage and air throw data shall be included on the detail drawing submittal.

2.12.4 Louvers

Horizontal air discharge units shall have individually adjustable horizontal louvers to direct discharge air horizontally as desired. A louvered back, heavy grille, or wire guard shall be provided for inlet air.

2.12.5 Fans and Motors

Fans shall be the propeller type direct connected to fan motor, dynamically balanced, and designed specifically for unit heater application and low noise level. Sleeve type bearings shall have ample provisions for lubrication and oil reservoir, and shall be effectively sealed against loss of lubrication and entrance of dirt. Ball and roller type bearings shall be sealed, self-aligning and permanently lubricated. Fan motor shall be totally enclosed, continuous duty with built-in manually reset thermal overload protection. Motors 373 W (1/2 horsepower) and larger shall be three-phase unless otherwise shown. Single-phase motors shall be permanent split capacitor, capacitor-start, or shaded pole type. Motor shall operate from the same power supply as the heater, and at the same voltage unless a factory-furnished step-down transformer is provided. Motor speed shall not exceed 1800 rpm.

2.12.6 Limit Controls

Manual reset thermal overheat protection of unit shall be provided to protect against overheating of the unit and mounted in a convenient location.

2.12.7 Contactor

Unit shall have factory-installed magnetic contactor, for remote thermostatic operation, which shall disconnect all ungrounded conductors to the heater. Contactor shall be rated for 100,000-cycle duty. A control transformer shall be provided when necessary to supply 120 volt thermostat control circuit for each heater.

2.12.8 Remote Controls

Room thermostat for pilot duty shall be provided where shown. Thermostat shall have an approximate range of from 13 to 30 degrees C (55 to 85 degrees F) and an operating differential of 1.7 degrees C (3 degrees F) or less. A fused safety disconnect switch or circuit breaker, and a low-voltage-release stop-start push button station shall be provided in NEMA ICS 6, Type 1 enclosures and wall mounted 1370mm (4 feet 6 inches) above floor near the heater or as shown.

Control devices shall be connected to the unit heater with wire in conduit.

2.12.9 Wiring

Heaters shall be furnished complete, factory prewired to terminal strips, ready to receive branch circuit and control connections.

2.13 FACTORY PAINTING

Units which are not of galvanized construction according to ASTM A 123 or ASTM A 924 shall be factory painted with a corrosion resisting paint finish. Internal and external ferrous metal surfaces shall be cleaned, phosphatised and coated with a paint finish which has been tested according to ASTM B 117, ASTM D 1654, and ASTM D 3359. Evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors shall be submitted. Rating of failure at the scribe mark shall be not less than 6, average creepage not greater than 3 mm.Rating of the inscribed area shall not be less than 10, no failure. On units constructed of galvanized steel which have been welded, exterior surfaces of welds or welds that have burned through from the interior shall receive a final shop docket of zinc-rich protective paint according to ASTM D 520 Type I.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

3.1.1 Piping

Pipe and fittings shall be installed in accordance with Section 15569, WATER HEATING; GAS; UP TO 20 MBTUH for heating water piping and dual temperature piping, and Section 15650, CENTRAL REFRIGERATED AIR CONDITIONING SYSTEM for chilled water piping and refrigerant piping.

3.1.2 through 3.1.4 NOT USED

3.1.5 Condensate Drain Lines

Water seals shall be provided in the condensate drain from all units except room fan-coil units. The depth of each seal shall be 50 mm plus 0.1 mm for each Pa, of the total static pressure rating of the unit to which the drain is connected. Water seals shall be constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Pipe cap or plug cleanouts shall be provided where indicated. Drains indicated to connect to the sanitary waste system shall be connected by an indirect waste fitting. Air conditioner drain lines shall be insulated as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.6 through 3.1.8 NOT USED

3.1.9 Equipment and Installation

Frames and supports shall be provided for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Air handling units shall be floor mounted or ceiling hung, as indicated. The method of anchoring and fastening shall be as detailed. Floor-mounted equipment, unless otherwise indicated, shall be set on not less than 150 mm (6 inch) concrete pads or curbs doweled in place. Concrete foundations for circulating pumps shall be heavy enough to minimize the intensity of the vibrations transmitted to the piping and the surrounding

structure, as recommended in writing by the pump manufacturer. In lieu of a concrete pad foundation, a concrete pedestal block with isolators placed between the pedestal block and the floor may be provided. The concrete foundation or concrete pedestal block shall be of a mass not less than three times the weight of the components to be supported. Lines connected to the pump mounted on pedestal blocks shall be provided with flexible connectors. Foundation drawings, bolt-setting information, and foundation bolts shall be furnished prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Concrete for foundations shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.1.10 Access Panels

Access panels shall be provided for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METALS.

3.1.11 Flexible Connectors

Pre-insulated flexible connectors and flexible duct shall be attached to other components in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the connector or duct manufacturer and shall be provided at the intervals recommended.

3.1.12 Sleeved and Framed Openings

Space between the sleeved or framed opening and the duct or the duct insulation shall be packed as specified in Section 07270 FIRESTOPPING for fire rated penetrations. For non-fire rated penetrations, the space shall be packed as specified in Section 07920 JOINT SEALING.

3.1.13 Metal Ductwork

Installation shall be according to SMACNA-06 unless otherwise indicated. Duct supports for sheet metal ductwork shall be according to SMACNA-06, unless otherwise specified. Friction beam clamps indicated in SMACNA-06 shall not be used. Risers on high velocity ducts shall be anchored in the center of the vertical run to allow ends of riser to move due to thermal expansion. Supports on the risers shall allow free vertical movement of the duct. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

3.1.14 through 3.1.17 NOT USED

3.1.18 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, temporary dust control protection shall be provided. The distribution system (supply and return) shall be protected with temporary seal-offs at all inlets and outlets at the end of each day's work. Temporary protection shall remain in place until system is ready for startup.

3.1.19 Insulation

SAFETY PAYS

Thickness and application of insulation materials for ductwork, piping, and equipment shall be according to Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Outdoor air intake ducts and plenums shall be externally insulated up to the point where the outdoor air reaches the conditioning unit.

3.1.20 Duct Test Holes

Holes with closures or threaded holes with plugs shall be provided in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Extensions, complete with cap or plug, shall be provided where the ducts are insulated.

3.1.21 Power Roof Ventilator Mounting

Foamed 13 mm (1/2 inch) thick, closed-cell, flexible elastomer insulation shall cover width of roof curb mounting flange. Where wood nailers are used, holes shall be pre-drilled for fasteners.

3.1.22 Power Transmission Components Adjustment

V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.2 FIELD PAINTING AND PIPING IDENTIFICATION

Finish painting of items only primed at the factory or surfaces not specifically noted otherwise and identification for piping are specified in Section 09900 PAINTING, GENERAL.

3.3 NOT USED

3.4 NOT USED

3.5 CLEANING AND ADJUSTING

Pipes shall be cleaned free of scale and thoroughly flushed of foreign matter. A temporary bypass shall be provided for water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented. Inside of air terminal units,ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided prior to startup of all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.6 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING AND BALANCING

OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.7 PERFORMANCE TESTS

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be made as necessary to produce the conditions indicated or specified. Capacity tests and general operating tests shall be conducted by an experienced engineer. Tests shall cover a period of not less than 3 days for each system and shall demonstrate that the entire system is functioning according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

3.8 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 4 hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

--END OF SECTION--

SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

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SUBMITTAL REGISTER (ER415-1-10)	CONTRACT NO.

TITLE AND LOCATION	CONTRACTOR	SPEC. SECTION
Discom Barracks Complex, Phase III Ft. Campbell, Kentucky		15895

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.4 SUBMITTALS										
			SD-01 Data										
			Components and Equipment Data; GA.										
			SD-04 Drawings										
			Air Supply, Distribution, Ventilation, and Exhaust Equipment; GA.										
			SD-06 Instructions										
			Test Procedures; FIO.										
			Welding Procedures; FIO.										
			System Diagrams; GA.										
			SD-07 Schedules										
			Test Schedules; FIO.										
			Field Training Schedule; FIO.										
			SD-08 Statements										
			Similar Services; FIO.										
			Welding Qualification; FIO.										
			SD-09 Reports										
			Test Reports; FIO.										
			SD-13 Certificates										
			Bolts; FIO.										
			SD-19 Operation and Maintenance Manuals										
			Air Supply, Distribution, Ventilation, and Exhaust Manuals; GA.										

SAFETY PAYS

SECTION 15950

HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500	(1989) Test Methods for Louvers, Dampers, and Shutters

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 269	(1994a) Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM B 88	(1995a) Seamless Copper Water Tube
ASTM D 635	(1991) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM D 1693	(1994) Environmental Stress-Cracking of Ethylene Plastics

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.34	(1988) Valves - Flanged, Threaded, and Welding End
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV VIII Div 1	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

CODE OF FEDERAL REGULATIONS (CFR)

47 CFR 15	Radio Frequency Devices

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991) Surge Voltages in Low-Voltage AC Power Circuits

INTERNATIONAL SOCIETY FOR MEASUREMENT AND CONTROL (ISA)

ISA S7.3	(1975; R 1981) Quality Standard for Instrument Air

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996) National Electrical Code
NFPA 90A	(1996) Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 94	(1991; Rev thru May 1996) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 268A	(1993; Rev Apr 1994) Smoke Detectors for Duct Application
UL 508	(1993) Industrial Control Equipment
UL 555S	(1993; Rev thru Apr 1995) Leakage Rated Dampers for Use in Smoke-Control Systems
UL 916	(1994; Rev thru Aug 1995) Energy Management Equipment

1.2 GENERAL REQUIREMENTS

1.2.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

1.2.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, shall arrange such work accordingly, and shall furnish all work necessary to meet such conditions.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment Compliance Booklet; GA.

SAFETY PAYS

An HVAC control system equipment compliance booklet (ECB) in indexed booklet form with numbered tabs separating the information on each device. It shall consist of, but not be limited to, data sheets and catalog cuts which document compliance of all devices and components with the specifications. The ECB shall be indexed in alphabetical order by the unique identifiers. Devices and components which do not have unique identifiers shall follow the devices and components with unique identifiers and shall be indexed in alphabetical order according to their functional name. The ECB shall include a bill of materials for each HVAC control system. The bill of materials shall function as the table of contents for the ECB and shall include the device's unique identifier, device function, manufacturer, model/part/catalog number used for ordering, and tab number where the device information is located in the ECB.

SD-04 Drawings

HVAC Control System; GA.

Drawings on A1 841 mm by 594 mm sheets in the form and arrangement shown. The drawings shall use the same abbreviations, symbols, nomenclature and device identifiers shown. Each control-system element on a drawing shall have a unique identifier as shown. All HVAC control system drawings shall be delivered together as a complete submittal. Drawings shall be submitted for each HVAC system.

a. HVAC control system drawings shall include the following:

Sheet One: Drawing index, HVAC control system legend.

Sheet Two: Valve schedule, damper schedule.

Sheet Three: Not Used.

Sheet Four: HVAC control system schematic and equipment schedule.

Sheet Five: HVAC control system sequence of operation and ladder diagram.

Sheet Six: HVAC control panel arrangement, control panel cross-section, and control panel inner door layout.

Sheet Seven: HVAC control panel back-panel layout.

Sheet Eight: Control loop wiring diagrams.

Sheet Nine: Motor starter and relay wiring diagram.

Note: Repeat sheets four through nine for each AHU system.

b. An HVAC control system drawing index showing the name and number of the building, military site, State or other similar designation, and Country. The drawing index shall list all HVAC control system drawings, including the drawing number, sheet number, drawing title, and computer filename when used.

c. An HVAC control system legend showing generic symbols and the name of devices shown on the HVAC control system drawings.

d. A valve schedule showing each valve's unique identifier, size, flow coefficient (Cv), pressure drop at specified flow rate, spring range, positive positioner range, actuator size, close-off pressure data, dimensions, and access and clearance requirements data.

e. A damper schedule showing each damper and actuator's identifier, nominal and actual sizes, orientation of axis and frame, direction of blade rotation, spring ranges, operation rate, positive positioner ranges, locations of actuators and damper end switches, arrangement of sections in multi-section dampers, and methods of connecting dampers, actuators, and linkages. The damper schedule shall include the maximum leakage rate at the operating static-pressure differential. The damper schedule shall contain actuator selection data supported by calculations of the torque required to move and seal the dampers, access and clearance requirements.

f. Not Used.

g. An HVAC control system equipment schedule showing the control loop, device unique identifier, device function, setpoint, input range, and additional important parameters (i.e. output range).

h. An HVAC control system sequence of operation.

i. An HVAC control system ladder diagram showing all relays, contacts, pilot lights, switches, fuses and starters connected to the control system.

j. HVAC control panel arrangement drawings showing both side and front views of the panel. The drawing shall show panel and mounting dimensions.

k. HVAC control panel cross-section drawings showing mounting rails and standoffs for devices.

l. HVAC control panel inner door layout drawings showing both front and rear views of the inner door. The drawings shall show device locations, labels, nameplate legends, and fabrication details.

m. HVAC control panel back-panel layout drawings showing device locations, labels, nameplate legends, terminal block layout, fabrication details, and enclosure operating temperature-rise calculations.

n. HVAC control system wiring diagrams showing functional wiring diagrams of the interconnection of conductors and cables to HVAC control panel terminal blocks and to the identified terminals of devices, starters and package equipment. The wiring diagrams shall show all necessary jumpers and ground connections. The wiring diagrams shall show the labels of all conductors. Sources of power required for HVAC control systems and for packaged-equipment control systems shall be identified back to the panel-board circuit breaker number, HVAC system control panel, magnetic starter, or packaged equipment control circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown.

SD-08 Statements

Commissioning Procedures; GA.

a. Six copies of the HVAC control system commissioning procedures, in indexed booklet form, 60 days prior to the scheduled start of commissioning. Commissioning procedures shall be provided for each HVAC control system, and for each type of terminal-unit control system. The commissioning procedures shall reflect the format and language of this specification, and refer to devices by their unique identifiers as shown. The commissioning procedures shall be specific for each HVAC system, and shall give detailed step-by-step procedures for commissioning of the system.

b. Commissioning procedures documenting detailed, product-specific set-up procedures, configuration procedures, adjustment procedures, and calibration procedures for each device. Where the detailed product-specific commissioning procedures are included in manufacturer supplied manuals, reference may be made in the HVAC control system

commissioning procedures to the manuals.

c. Commissioning procedures documenting controller configuration checksheets for each controller listing all configuration parameters, dip switch and jumper settings, and initial recommended P, I and D values. The configuration parameters shall be listed in the order in which they appear during the configuration process. Each configuration parameter shall be noted as being: set per specs with no field adjustment required, set per specs but field adjustable, or not applicable.

d. Commissioning procedures showing a time clock configuration checksheet listing all parameters, and switch settings. The parameters shall be listed in the order which they appear during the setup process.

e. An HVAC control system commissioning procedures equipment list that lists the equipment to be used to accomplish commissioning. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

Performance Verification Test Procedures; GA.

Six copies of the HVAC control system performance verification test procedures, in indexed booklet form, 60 days before the Contractor's scheduled test dates. The performance verification test procedures shall refer to the devices by their unique identifiers as shown, shall explain, step-by-step, the actions and expected results that will demonstrate that the HVAC control system performs in accordance with the sequences of operation. An HVAC control system performance verification test equipment list shall be included that lists the equipment to be used during performance verification testing. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

Training Course Materials; GA.

Six copies of HVAC control system training course material 30 days prior to the scheduled start of the training course. The training course material shall include the operation manual, maintenance and repair manual, and paper copies of overheads used in the course. An HVAC control system training course, in outline form, with a proposed time schedule. Approval of the planned training schedule shall be obtained from the Government at least 60 days prior to the start of the training.

SD-09 Reports

Commissioning Report; GA.

Six copies of the HVAC control system commissioning report, in indexed booklet form, within 30 days after completion of the system commissioning. The commissioning report shall include data collected during the HVAC control system commissioning and shall follow the format of the commissioning procedures. The commissioning report shall include all controller and time clock checksheets with final values listed for all parameters, setpoints, P, I, D setting constants, calibration data for all devices, and results of adjustments.

Performance Verification Test Report; GA.

Six copies of the HVAC control system performance verification test report, in indexed booklet form, within 30 days after completion of the test. The HVAC control system performance verification test report shall include data collected during the HVAC control system performance verification test. The original copies of data gathered during the performance verification test shall be turned over to the Government after Government approval of the test results.

SD-18 Records

Service Organizations; GA.

Six copies of a list of service organizations qualified to service the HVAC control system. The list shall include the service organization name, address, technical point of contact and telephone number, and contractual point of contact and telephone number.

SD-19 Operation and Maintenance Manuals

Operation Manual; GA.

Maintenance and Repair Manual; GA.

Six copies of the HVAC control system operation manual and HVAC control system maintenance and repair manual for each HVAC control system 30 days before the date scheduled for the training course.

1.4 DELIVERY AND STORAGE

Products shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants, within the storage-condition limits published by the equipment manufacturer. Dampers shall be stored so that seal integrity, blade alignment and frame alignment are maintained.

1.5 OPERATION MANUAL

An HVAC control system operation manual for each HVAC control system, in indexed booklet form, shall be provided. The operation manual shall include the HVAC control system sequence of operation, and procedures for the HVAC system start-up, operation and shut-down. The operation manual shall include as-built HVAC control system detail drawings. The operation manual shall include the as-built controller configuration checksheets, the as-built time clock configuration checksheet, the HVAC control system front panel description, the procedures for changing HVAC system controller setpoints, the procedures for gaining manual control of processes, the time clock manufacturer's manual control of processes, the time clock manufacturer's operation manual, and the controller manufacturer's operation manual.

a. The HVAC control system front panel description shall explain the meaning and use of the lights, switches, gauges, and controller displays located in the front panel. Each light, switch, gauge, and display described shall be numbered and referenced to a drawing of the front panel.

b. The procedures for changing HVAC system controller setpoints shall describe the step-by-step procedures required to change: the process variable setpoints of controllers, the alarm setpoints of controllers, the controller bias settings, and controller setpoint reset schedules.

c. The procedures for gaining manual control of processes shall describe step-by-step procedures required to gain manual control of devices and manually adjust their positions.

1.6 MAINTENANCE AND REPAIR MANUAL

An HVAC control system maintenance and repair manual for each HVAC control system, in indexed booklet form in hardback binders, shall be provided. The maintenance and repair manual shall include the routine maintenance checklist, a recommended repair methods list, a list of recommended maintenance and repair tools, the qualified service

organization list, the as-built commissioning procedures and report, the as-built performance verification test procedures and report, and the as-built equipment data booklet (EDB).

a. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all devices listed in the equipment compliance booklet (ECB), the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.

b. The recommended repair methods list shall be arranged in a columnar format and shall list all devices in the equipment compliance booklet (ECB) and state the guidance on recommended repair methods, either field repair, factory repair, or whole-item replacement.

c. The as-built equipment data booklet (EDB) shall include the equipment compliance booklet (ECB) and all manufacturer supplied user manuals and information.

d. If the operation manual and the maintenance and repair manual are provided in a common volume, they shall be clearly differentiated and separately indexed.

PART 2 PRODUCTS

2.1 MATERIAL AND EQUIPMENT

Material and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization. The Contractor shall submit a certified list of qualified permanent service organizations and qualifications. These service organizations shall be reasonably convenient to the equipment on a regular and emergency basis during the warranty period.

2.2 GENERAL EQUIPMENT REQUIREMENTS

2.2.1 Electrical and Electronic Devices

All electrical, electronic, and electro-pneumatic devices not located within an HVAC control panel shall have a NEMA Type 1 enclosure in accordance with NEMA 250 unless otherwise shown.

2.2.2 Standard Signals

The output of all analog transmitters and the analog input and output of all single-loop controllers and function modules shall be 4-to-20 mAdc signals. The signal shall originate from current-sourcing devices and shall be received by current-sinking devices.

2.2.3 Ambient Temperature Limits

Ambient Temperature Actuators and positive positioners, and transmitters shall operate within temperature limit ratings of 5 to 60 degrees C. All panel-mounted instruments shall operate within limit ratings of 2 to 50 degrees C and 10

percent to 95 percent relative humidity, noncondensing. All devices installed outdoors shall operate within limit ratings of minus 40 to plus 65 degrees C.

2.2.4 Nameplates, Lens Caps, and Tag Nameplates

Nameplates, lens caps, and lens caps bearing legends as shown and tags bearing device-unique identifiers as shown shall have engraved or stamped characters. A plastic or metal tag shall be mechanically attached directly to each device or attached by a metal chain or wire. Each air flow measurement station shall have a tag showing flow rate range for signal output range, duct size, and identifier as shown.

2.3 MATERIALS

2.3.1 NOT USED

2.3.2 Wiring

2.3.2.1 Terminal Blocks

Terminal blocks shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

2.3.2.2 Control Wiring for 24-Volt Circuits

Control wiring for 24-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 300-volt service.

2.3.2.3 Wiring for 120-Volt Circuits

Wiring for 120-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 600-volt service.

2.3.2.4 Analog Signal Wiring Circuits

Analog signal wiring circuits within control panels shall not be less than 20 AWG and shall be rated for 300-volt service.

2.3.2.5 Instrumentation Cable

Instrumentation cable shall be 18 AWG, stranded copper, single or multiple-twisted, minimum 51 mmlay of twist, 100 percent shielded pairs, and shall have a 300-volt insulation. Each pair shall have a 20 AWG tinned-copper drain wire and individual overall pair insulation. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape, overall 20 AWG tinned-copper cable drain wire, and overall cable insulation.

2.3.2.6 Nonconducting Wiring Duct

Nonconducting wiring duct in control panels shall have wiring duct in control panels shall have slotted sides, snap-on duct covers, have slotted sides, snap-on duct covers, fittings for connecting ducts, mounting clips for securing ducts, and wire-retaining clips.

2.3.2.7 Transformers

Step-down transformers shall be utilized where control equipment operates at lower than line circuit voltage. Transformers, other than transformers in bridge circuits, shall have primaries wound for the voltage available and secondaries wound for the correct control circuit voltage. Transformers shall be sized so that the connected load is 80 percent of the rated capacity or less. Transformers shall conform to UL 508.

2.4 ACTUATORS

Actuators shall be electric or electronic as shown and shall be provided with mounting and connecting hardware. Actuators shall fail to their spring-return positions on signal or power failure. The actuator stroke shall be limited in the direction of power stroke by an adjustable stop. Actuators shall have a visible position indicator. Actuators shall smoothly open or close the devices to which they are applied and shall have a full stroke response time of 60 seconds or less. Electric or electronic actuators operating in series shall have an auxiliary actuator driver. Electric actuators shall have an oil-immersed gear train.

2.4.1 Valve Actuators

Valve actuators shall be selected to provide a minimum of 125 percent of the motive power necessary to operate the valve over its full range of operation.

2.5 AUTOMATIC CONTROL VALVES

2.5.1 Valve Assembly

Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Unless otherwise stated, valves shall have globe style bodies. Valve bodies shall be designed for not less than 862 kPa working pressure or 150 percent of the system operating pressure, whichever is greater. Valve leakage rating shall be 0.01 percent of rated Cv.

2.5.2 Butterfly-Valve Assembly

Butterfly valves shall be threaded lug type suitable for dead-end service, and for modulation to the fully-closed position, with carbon-steel bodies and noncorrosive discs, stainless steel shafts supported by bearings, and EPDM seats suitable for temperatures from minus 29 to plus 120 degrees C. Valves shall have a manual means of operation independent of the actuator. The rated Cv for butterfly valves shall be the valve Cv at 70% open (60 degrees open).

2.5.3 Two-Way Valves

Two-way modulating valves shall have equal-percentage characteristics.

2.5.4 Three-Way Valves

Three-way valves shall provide linear flow control with constant total flow throughout full plug travel.

2.5.5 Duct-Coil and Terminal-Unit-Coil Valves

Control valves with either flare-type or solder-type ends shall be provided for duct or terminal-unit coils. Flare nuts shall be furnished for each flare-type end valve.

2.5.6 Valves for Chilled-Water Service

Bodies for valves 40 mm (1-1/2 inches) and smaller shall be brass or bronze, with threaded or union ends. Bodies for valves from 50 to 80 mm (2 to 3 inches) inclusive shall be of brass, bronze or iron. Bodies for 50 mm (2 inch) valves shall have threaded ends. Bodies for valves from 65 to 80 mm (2-1/2 to 3 inches) shall have flanged-end connections. Valve Cv shall be within 100 percent to 125 percent of the Cv shown. Internal valve trim shall be brass or bronze except that valve stems may be type 316 stainless steel. Valves 100 mm (4 inches)and larger shall be butterfly valves.

2.5.7 Valves for Hot-Water Service

Valves for hot-water service below 121 degrees C shall be as follows: Bodies for valves 40 mm (1-1/2 inches) and smaller shall be brass or bronze, with threaded or union ends. Bodies for 50 mm (2 inches) valves shall have threaded ends. Bodies for valves from 50 to 80 mm (2 to 3 inches) inclusive shall be of brass, bronze, or iron. Bodies for valves 100 mm (4 inches) and larger shall be iron. Bodies for valves 65 mm (2-1/2 inches)and larger shall be provided with flanged-end connections. Valve Cv shall be within 100 percent to 125 percent of the Cv shown. Internal trim (including seats, seat rings, modulating plugs, and springs) of valves controlling water hotter than 99 degrees Cshall be Type 316 stainless steel. Internal trim for valves controlling water 99 degrees Cor less shall be brass or bronze. Nonmetallic parts of hot-water control valves shall be suitable for a minimum continuous operating temperature of 121 degrees C or 10 degrees C above the system design temperature, whichever is higher. Valves 100 mm (4 inches) is higher. Valves 100 mm (4 inches)and larger shall be butterfly valves.

2.6 DAMPERS

2.6.1 Damper Assembly

A single damper section shall have blades no longer than 1.2 m and shall be no higher than 1.8 m. Maximum damper blade width shall be 203 mm. Larger sizes shall be made from a combination of sections. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by folding the edges. All blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section will not be located directly in the air stream. Damper axles shall be 13 mm (0.5 inch)(minimum) plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not exceed 10 Pa at 5 m/s in the wide-open position. Frames shall not be less than 50 mm in width. Dampers shall be tested in accordance with AMCA 500.

2.6.1.1 Operating Links

Operating links external to dampers (such as crankarms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers) shall withstand a load equal to at least twice the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless steel. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crankarms shall control the open and closed positions of dampers.

2.6.1.2 Damper Types

Dampers shall be opposed blade type.

2.6.2 Outside-Air, Return-Air, and Relief-Air Dampers

The dampers shall be provided where shown. Blades shall have interlocking edges and shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Dampers shall not leak in excess of 102 L/s per square meterat 1,000 Pa (gauge) static pressure when closed. Seals shall be suitable for an operating temperature range of minus 40 to plus 93 degrees C. Dampers

shall be rated at not less than 10 m/s air velocity.

2.6.3 Mechanical and Electrical Space Ventilation Dampers

The dampers shall be as shown. Dampers shall not leak in excess of 406 L/s per square meter at 1,000 Pa(gauge) static pressure when closed. Dampers shall be rated at not less than 7.8 m/s air velocity.

2.7 DUCT SMOKE DETECTORS

Duct smoke detectors shall conform to the requirements of UL 268A. Duct smoke detectors shall have perforated sampling tubes extended into the air duct. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have manual reset. Detectors shall be rated for air velocities that include air flows between 2.5 and 20 m/s. Detectors shall be powered from the HVAC control panel. Detectors shall have two sets of normally open alarm contacts and two sets of normally closed alarm contacts. Detectors shall be connected to the building fire alarm panel for alarm initiation. A remote annunciation lamp and accessible remote reset switch shall be provided for duct detectors that are mounted eight feet or more above the finished floor and for detectors that are not readily visible. Remote lamps and switches as well as each affected fan unit shall be properly identified in etched rigid plastic placards.

2.8 INSTRUMENTATION

2.8.1 Measurements

Transmitters shall be factory calibrated to provide an output of 4 to 20 mAdc over the indicated ranges:

a. Conditioned space temperature, from 10 to 30 degrees C.

b. Duct temperature, from 5 to 60 degrees C except that return-air temperature for economizer operation shall be minus 35 to plus 55 degrees C.

c. Chilled-water temperature, from minus 1 to plus 38 degrees C.

d. Heating hot-water temperature, from 38 to 121 degrees C.

e. Outside-air temperature, from minus 35 to plus 55 degrees C.

2.8.2 Temperature Instruments

2.8.2.1 Resistance Temperature Detectors (RTD)

Temperature sensors shall be 100 ohms 3- or 4-wire RTD. Each RTD shall be platinum with a tolerance of plus or minus 0.1 percent at 0 degrees C,and shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper. Each RTD shall be furnished with an RTD transmitter as specified, integrally-mounted unless otherwise shown.

2.8.2.2 Continuous-Averaging RTD

Continuous-averaging RTDs shall have a tolerance of plus or minus 0.5 degree C at the reference temperature, and shall be of sufficient length to ensure that the resistance represents an average over the cross-section in which it is installed. The sensing element shall have a bendable copper sheath. Each averaging RTD shall be furnished with an RTD transmitter as specified, to match the resistance range of the averaging RTD.

2.8.2.3 RTD Transmitter

The RTD transmitter shall accept a 3-wire 100 ohm RTD input. The transmitter shall be a 2-wire, loop-powered device. The transmitter shall produce a linear 4-to-20 mA dc output corresponding to the required temperature measurement. The output error shall not exceed 0.1 percent of the calibrated span. The transmitter shall include offset and span adjustments.

2.8.3 through 2.8.5 NOT USED

2.8.6 Differential Pressure Instruments

The instrument shall be a pressure transmitter with an integral sensing element. The instrument over pressure rating shall be 300 percent of the operating pressure. The sensor/transmitter assembly accuracy shall be plus or minus 2 percent of full scale. The transmitter shall be a 2-wire, loop-powered device. The transmitter shall produce a linear 4-to-20 mA dc output corresponding to the required pressure measurement. Each transmitter shall have offset and span adjustments.

2.8.7 Thermowells

Thermowells shall be Series 300 stainless steel with threaded brass plug and chain, 50 mm lagging neck and extension-type well, and inside diameter and insertion length as required for the application.

2.8.8 Sunshields

Sunshields for outside-air temperature sensing elements shall prevent the sun from directly striking the temperature sensing elements. The sunshields shall be provided with adequate ventilation so that the sensing element responds to the ambient temperature of the surroundings. The top of each sunshield shall have a galvanized-metal rainshield projecting over the face of the sunshield. The sunshields shall be painted white or shall be unpainted aluminum.

2.9 THERMOSTATS

Thermostat ranges shall be selected so that the setpoint is adjustable between plus or minus 5 degrees C of the setpoint shown. Thermostats shall be electronic or electric.

2.9.1 Nonmodulating Room Thermostats

Contacts shall be single-pole double-throw (SPDT), hermetically sealed, and wired to identified terminals. Maximum differential shall be 2.75 degrees C. Room thermostats shall be enclosed with separate locking covers (guards). Thermostats shall have manual switches as required by the application.

2.9.2 NOT USED

2.9.3 Modulating Room Thermostats

Modulating room thermostats shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Each thermostat shall have an adjustable throttling range of 2 to 4 degrees C for each output. Room thermostats shall be enclosed with separate locking covers (guards).

2.9.4 Nonmodulating Capillary Thermostats and Aquastats

Each thermostat shall have a capillary length of at least 1.5 meters, Aquastats shall be of the strap-on type, with 5 degrees C fixed differential.

2.9.5 Low-Temperature-Protection Thermostats

Low-temperature-protection thermostats shall be, low-temperature safety thermostats, with NO and NC contacts, with an element length of 6 meters,which shall respond to the coldest 460 mm segment.

2.9.6 Modulating Capillary Thermostats

Each thermostat shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Thermostats shall have adjustable throttling ranges of 2 to 4 degrees C for each output.

2.9.7 Fan-Coil Unit and Cabinet Unit Heater Room Thermostats

Fan-coil unit room thermostats in personnel living spaces shall be of the low-voltage type with locking covers. Electrical rating shall not exceed 2.5 amperes at 30 volts ac. Housing shall be corrosion resistant metal or molded plastic.

2.9.7.1 Fan Coil Unit Thermostats

Fan-coil unit combination heating-cooling thermostats shall be occupant adjustable single setpoint type. The thermostat shall have a single pole, double throw (SPDT) switch hermetically sealed and actuated by a bimetallic or bellows type element. The single setpoint shall be adjustable between 15.6 degrees C and 29.4 degrees C (60 degrees F and 85 degrees F). A changeover aquastat providing automatic summer-winter changeover for thermostats by sensing the supplied fluid temperature shall be provided.

2.9.7.2 Cabinet Unit Heater Thermostats

Cabinet unit heater heating thermostats shall be provided with fixed heat anticipation and shall have a single-pole, single-throw (SPST) switch hermetically sealed and actuated by a metallic or bellows type element. Thermostats shall be provided with external temperature setting devices with a factory set maximum of 20 degrees C (68 degrees F). Heating thermostats shall have an adjustable range of at least 7.2 degrees C (13 degrees F) below 20 degrees C (68 degrees F).

2.10 PRESSURE SWITCHES AND SOLENOID VALVES

2.10.1 Pressure Switches

Each switch shall have an adjustable setpoint with visible setpoint scale. Range shall be as shown. Differential adjustment shall span 20 to 40 percent of the range of the device.

2.10.2 Differential-Pressure Switches

Each switch shall be an adjustable diaphragm-operated device with two SPDT contacts, with taps for sensing lines to be connected to duct pressure fittings designed to sense air pressure. These fittings shall be of the angled-tip type with tips pointing into the air stream. The setpoint shall not be in the upper or lower quarters of the range and the range shall not be more than three times the setpoint. Differential shall be a maximum of 35 Pa at the low end of the range and 85 Pa at the high end of the range.

2.11 INDICATING DEVICES

2.11.1 Thermometers

2.11.1.1 Piping System Thermometers

Piping system thermometers shall have brass, malleable iron or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 230 mm scale. Thermometers for piping systems shall have rigid stems with straight, angular, or inclined pattern.

2.11.1.2 Piping System Thermometer Stems

Thermometer stems shall have expansion heads as required to prevent breakage at extreme temperatures. On rigid-stem thermometers, the space between bulb and stem shall be filled with a heat-transfer medium.

2.11.1.3 NOT USED

2.11.1.4 Averaging Air-Duct Thermometers

Averaging thermometers shall have a 90 mm (nominal) dial, with black legend on white background, and pointer traveling through a 270-degree arc.

2.11.1.5 Accuracy

Thermometers shall have an accuracy of plus or minus 1 percent of scale range. Thermometers shall have a range suitable for the application.

2.11.2 Pressure Gauges

Gauges shall be 50 mm (nominal) size, back connected, suitable for field or panel mounting as required, shall have black legend on white background, and shall have a pointer traveling through a 270-degree arc. Accuracy shall be plus or minus 3 percent of scale range. Gauges shall meet requirements of ASME B40.1.

2.11.2.1 NOT USED

2.11.2.2 NOT USED

2.11.2.3 Hydronic-System Gauges

Gauges for hydronic-system applications shall have ranges and graduations as shown.

2.11.3 Low Differential Pressure Gauges

Gauges for low differential-pressure measurements shall be a minimum of 90 mm (nominal) size with two sets of pressure taps, and shall have a diaphragm-actuated pointer, white dial with black figures, and pointer zero adjustment. Gauges shall have ranges and graduations as shown. Accuracy shall be plus or minus 2 percent of scale range.

2.12 SINGLE-LOOP CONTROLLERS

2.12.1 Controller Features

The controller shall be a microprocessor-based single-loop device that does not require Contractor generated software. The controller shall be mountable in a panel cutout measuring 92 by 92 mm. The controller shall have field scalable process variable, a remote setpoint analog input and an analog output with adjustable high and low end limits and proportional control manual reset adjustment. The analog output shall result from proportional, integral and derivative (PID) control. The analog output shall be configurable as direct acting and reverse acting. The controller shall have keyboard, display, auto/manual selection for control of its analog output, remote setpoint adjustment/local setpoint adjustment selection with adjustable high-end and low-end limits, ratio and bias adjustments on remote setpoint input, operator-initiated self-tune/manual-tune selection, anti-reset wind-up feature, and 2 independent SPDT contact-closure outputs (PV alarm and deviation alarm). The controller shall be configurable to power-up in automatic with local setpoint control and in automatic with remote setpoint control. The range of hysteresis adjustment shall be not smaller than from 1 percent to 5 percent of process variable input span. The controller shall power the analog output loop to 20 milliamperes when connected to a load of 600 ohms. The controller shall be capable of retransmitting the process variable to 20 milliamperes when connected to 600 ohms. The controller shall have 5-year battery backup to store operating parameters or shall have nonvolatile memory.

2.12.2 Parameter Input and Display

Control parameters shall be entered and displayed directly, in the correct engineering units, through a series of keystrokes on a front-panel display with a 3-1/2 digit, 7-segment display, with decimal point and polarity indication. The use of this display shall allow manual interrogation of setpoint, mode constants, and values of the process variable and output.

2.12.3 Controller Electrical Requirements

Each controller shall be powered by 120 volts ac. Power consumption shall not be greater than 25 watts. Each controller shall provide electrical noise isolation between the ac power line and the process variable input, remote setpoint input, and output signals and of not less than 100 db at 60 Hz common-mode rejection ratio, and not less than 60 db at 60 Hz normal-mode rejection ratio.

2.12.4 Controller Accuracy

The controller shall have an accuracy of plus or minus 0.30 percent of input span, plus or minus 1 digit.

2.12.5 Self-Tuning

The controller self-tuning operation shall apply proportional, integral, and derivative modes of control and shall modify the mode constants as required. Self-tuning shall only be in operation when selected from the front panel.

2.12.6 Manual-Tuning

The controller manual-tuning operation shall provide proportional, integral, and derivative control modes, or any combination thereof, by means of individual mode constant adjustments. These adjustments shall be set for the appropriate value if a particular control mode action is desired, or to zero if that particular mode is not desired. The proportional-mode constant shall be adjustable from 0 to 200 percent of input signal range, the integral-mode constant shall be adjustable from 0 to 20 repeats per minute, and derivative-mode constant shall be adjustable from 0 to 5 minutes.

2.13 CONTROL DEVICES AND ACCESSORIES

Control device and accessory input impedance shall not exceed 250 ohms.

2.13.1 Function Modules

Function modules shall accept mA dc analog input signals to produce mAdc analog output signals or contact output signals. Modules shall have zero and span adjustments for analog outputs, and setpoint adjustments for contact outputs. Module output span accuracy shall be plus or minus 1 percent of input span. Modules shall be rail-mounted as shown. Power consumption shall be not greater than 5 watts.

2.13.1.1 Minimum-Position Switch and Temperature-Setpoint Device

Minimum-position switch and temperature-setpoint device shall accept a 1000 ohms potentiometer input and shall produce a steady analog output. In temperature setpoint applications the potentiometer shall be single-turn, suitable for wall mounting, enclosed in a locking metal or heavy duty plastic enclosure and shall have a graduated dial corresponding to the range of the setpoint adjustment. In a minimum position switch application the potentiometer shall be mounted on or internal to the minimum position switch. The device shall have its input signal electrically or optically isolated from output. Mounting socket shall be an 8 pin base with pins 1, 2, 3 ac power input, 4, 5, 6 input signal, 7, 8, output signal.

2.13.1.2 Signal-Inverter Modules

Signal inverter shall accept an analog input signal and shall have sufficient output capacity to drive the output signal through a circuit with an impedance of not less than 600 ohms. The output shall be electrically isolated from the input and the device shall have a moisture resistant coating. Mounting socket shall be an 8 pin base with pins 1, 2, 3 ac power input, 4, 5, 6 input signal, 7, 8, output signal.

2.13.1.3 High-Low Signal Selector

High-low signal-selector modules shall accept analog input signals and select either the highest or the lowest input signal as the output signal. The signal selector shall be powered by 120 Vac and the output signal shall be electrically isolated from the input signal.

2.13.1.4 Sequencer Modules (Dual Limit Alarm)

Sequencer modules (dual limit alarms) shall accept an analog input signal and shall provide two contact closure outputs. Each output shall have an adjustable independent contact setpoint with an adjustable switching differential range between 1 percent and 100 percent of the input span. The setpoint shall be adjustable between 0 percent and 100 percent of the input span. Setpoint and switching differential (deadband) adjustment potentiometers shall be internal, top-accessed potentiometers or screws. Sequencers shall return all contacts to their zero input signal condition when power is interrupted. The device shall have moisture resistant coating.

2.13.1.5 Loop Driver Modules

Loop driver module shall accept an analog input signal and shall have a circuit input impedance not greater than 100 ohms. The loop driver module shall have sufficient output capacity to drive the output signal through a circuit with an impedance range of not less than 1000 ohms. The output shall be electrically isolated from the input and the device shall have moisture resistant coating. Mounting socket shall be an 8 pin base with pins 1, 2, 3 ac power input, 4, 5, 6 input signal, 7, 8 output signal.

2.13.2 Relays

Relays shall be 2-pole, double-throw (2PDT) with a 10-ampere resistive rating at 120 Vac, and shall have an enclosed 120-Vac coil with 8 pin blade connectors, and a matching rail-mounted socket. Power consumption shall not be greater

than 3 watts.

2.13.3 Time-Delay Relays

Time delay relays shall be 2PDT with 8 pin connectors, dust cover, and a matching rail-mounted socket. Adjustable timing range shall be 0 to 5 minutes. Power consumption shall be not greater than 3 watts.

2.13.4 Time Clocks

Each time clock shall be a 365-day programmable timing device with 4 independently timed circuits. Each clock shall have a manual scheduling keypad and an alphanumeric display of all timing parameters. Timing parameters shall include: date in Gregorian calendar for month, day and day-of-month indication; and 24-hour time-of-day display, with one-minute resolution for programming the ON and OFF times for each circuit. Each clock shall allow programming of each circuit for 12 holiday periods for either ON or OFF events for any selected duration of the 365-day program. Each clock shall have capacity for programming 4 ON events and 4 OFF events per day for each circuit. The programmed events shall be assignable to a 365-day schedule. Each clock shall have automatic Standard Time and Daylight Saving Time adjustment, by input of the appropriate dates. Each time clock shall have automatic leap year correction. Each clock shall be provided with 4-day battery backup. Power consumption shall not be greater than 10 watts.

2.13.5 NOT USED

2.13.6 Direct Current (DC) Power Supply

One DC power supply shall be used to power all transmitters connected to the control panel. The power supply shall be 24 Vdc at not less than 1.2 amperes, with a peak-to-peak ripple not to exceed 0.03 percent of output voltage. Each power supply shall have a fused input, and shall be protected from voltage surges and powerline transients. The power supply output shall be protected against overvoltage and short circuits.

2.13.7 Power Line Conditioner (PLC)

PLCs shall be furnished for each controller panel. The PLCs shall provide both voltage regulation and noise rejection. The PLCs shall be of the ferro-resonant design, with no moving parts and no tap switching, while electrically isolating the secondary from the power line side. The PLCs shall be sized for 125 percent of the actual connected kva load. Characteristics of the PLC shall be as follows:

a. At 85 percent load, the output voltage shall not deviate by more than plus or minus 1 percent of nominal voltage when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal voltage.

b. During load changes of zero to full load, the output voltage shall not deviate by more than plus or minus 3 percent of nominal voltage. Full correction of load switching disturbances shall be accomplished within 5 cycles, and 95 percent correction shall be accomplished within 2 cycles of the onset of the disturbance.

c. Total harmonic distortion shall not exceed 3-1/2 percent at full load.

2.14 PILOT LIGHTS AND MANUAL SWITCHES

Pilot lights and switches shall be rectangular devices arranged in a horizontal matrix as shown. Momentary switches shall be non-illuminated. Interlocking switches shall have separately illuminated sections. Split legend lights shall have separately illuminated sections. Device illumination shall be by light-emitting diode or neon lamp.

2.15 HVAC SYSTEM CONTROL PANELS

2.15.1 Panel Assembly

The control panel shall be factory assembled and shipped to the job site as a single unit. The panel shall be fabricated as shown, and the devices shall be mounted as shown. Each panel shall be fabricated as a bottom-entry connection point for control-system electric power,control-system wiring, interconnection of control systems, interconnection of starters and external shutdown devices, and energy monitoring and control systems (EMCS) interface. Each panel shall have an operating temperature rise of not greater than 11 degrees C above an ambient temperature of 38 degrees C.

2.15.2 Panel Electrical Requirements

Each control panel shall be powered by nominal 120 volts ac, fused at 5 amps, terminating at the panel on terminal blocks. Instrument cases shall be grounded. Interior panel, interior door, and exterior panel enclosure shall be grounded.

2.15.3 Enclosure

The enclosure for each panel shall be a NEMA 12 single-door wall-mounted box conforming to NEMA 250, with continuous hinged and gasketed exterior door with print pocket and key lock, continuous hinged interior door, interior back panel, and ventilation louvers in back surface as shown. Inside finish shall be white enamel, and outside finish shall be gray primer over phosphatized surfaces.

2.15.4 Mounting and Labeling

Controllers, pilot lights, switches, IP's, and pressure gauge shall be mounted on the interior door as shown. Power conditioner, fuses and duplex outlet shall be mounted on the interior of the cabinet as shown. All other components housed in the panel shall be mounted on the interior back panel surface of the enclosure, behind the door on rails as shown. Controllers and gauges mounted on the front of the inner door shall be identified by a plastic or metal nameplate as shown that is mechanically attached to the panel. Function modules, relays, timeclocks, IP transducers, DC power supply, and other devices interior to the panel shall be identified by a plastic or metal nameplate that is mechanically attached to the panel. The nameplate shall have the inscription as shown. Lettering shall be cut or stamped into the nameplate to a depth of not less than 0.4 mm,and shall show a contrasting color, produced by filling with enamel or lacquer or by the use of a laminated material. Painting of lettering directly on the surface of the interior door or panel is not permitted.

2.15.5 Wiring

2.15.5.1 NOT USED

2.15.5.2 Panel Wiring

Interconnections wiring shall be installed in wiring ducts in such a way that devices can be added or replaced without disturbing wiring that is not affected by the change. Wiring to all devices shall have a 100 mm wiring loop in the horizontal wiring duct at each wiring connection. There shall be no wiring splices within the control panel. All interconnections required for power or signals shall be made on device terminals or panel terminal blocks, with not more than two wires connected to a terminal.

2.15.5.3 Panel Terminal Blocks

Terminal blocks shall be arranged in groups as shown. Instrument signal grounds at the same ground reference level shall end at a grounding terminal for connection to a common ground point. Wiring-shield grounds at the same reference level shall end at a grounding terminal for connection to a common ground point. Grounding terminal blocks shall be identified by reference level.

2.15.5.4 Wiring Identification

All wiring connected to controllers, time clocks and function modules shall be identified by function and polarity with full word identifiers, i.e., process variable input, remote setpoint input and control output.

2.15.6 EMCS Terminal Blocks

Terminal blocks shall be provided for connections to EMCS as shown. Analog signals shall require only the removal of jumpers to interface to EMCS.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION CRITERIA

The HVAC control system shall be installed and ready for operation, as specified and shown. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exterior shall be made watertight. The HVAC control system installation shall provide clearance for control system maintenance by maintaining access space between coils, access space to mixed-air plenums, and other access space required to calibrate, remove, repair, or replace control system devices. The control system installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

3.1.1 Device Mounting Criteria

Devices mounted in or on piping or ductwork, on building surfaces, in mechanical/electrical spaces, or in occupied space ceilings shall be installed in accordance with manufacturer's recommendations and as shown. Control devices to be installed in piping and ductwork shall be provided with all required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements shall not be used except as specified.

3.1.2 Wiring Criteria

Wiring external to control panels, including low-voltage wiring, shall be installed in metallic raceways. Wiring shall be installed without splices between control devices and HVAC control panels. Cables and conductors shall be tagged at both ends, with the identifier shown on the shop drawings, in accordance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Other electrical work shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR and as shown.

3.1.2.1 Power-Line Surge Protection

Equipment connected to ac circuits shall be protected from powerline surges. Equipment protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

3.1.2.2 Surge Protection for Transmitter and Control Wiring

HVAC system control panel equipment shall be protected against surges induced on control and transmitter wiring

installed outside and as shown. The equipment protection shall be tested in the normal mode and in the common mode, using the following two waveforms:

a. A 10-microsecond by 1000-microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

b. An 8-microsecond by 20-microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

3.1.2.3 Controller Output Loop Impedance Limitation

Controller output loops shall be constructed so that total circuit impedance connected to the analog output of a single-loop controller shall not exceed 600 ohms.

3.2 CONTROL SYSTEM INSTALLATION

3.2.1 Damper Actuators

Actuators shall not be mounted in the air stream. Multiple actuators operating a common damper shall be connected to a common drive shaft. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.

3.2.2 NOT USED

3.2.3 Room-Instrument Mounting

Room instruments shall be mounted so that their sensing elements are 1.5 m above the finished floor unless otherwise shown. Temperature setpoint device shall be recess mounted.

3.2.4 Smoke Detectors

Duct smoke detectors shall be provided in supply and return air ducts in accordance with NFPA 90A.

3.2.5 Manual Emergency Fan Shutdown Switches

Manual emergency fan shutdown switches shall be provided for air distribution fans in accordance with NFPA 90A. Switches shall be the manual-reset type. Switches shall be located and mounted in an accessible manner, approximately 1.2 m above the finished floor. Switches shall be properly identified in etched rigid plastic placards.

3.2.6 Low-Temperature-Protection Thermostats

For each 1.8 square meters of coil-face area, or fraction thereof, a thermostat shall be provided to sense the temperature at the location shown. The thermostat sensing element shall be installed in a serpentine pattern.

3.2.7 Averaging-Temperature Sensing Elements

Sensing elements shall have a total-element minimum length equal to 3.3 linear meter per square meter of duct cross-sectional area.

3.2.8 through 3.2.10 NOT USED

3.2.11 Indication Devices Installed in Piping and Liquid Systems

Gauges in piping systems subject to pulsation shall have snubbers. Gauges for steam service shall have pigtail fittings with cock. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

3.2.12 Control System Tubing

3.2.12.1 NOT USED

3.2.12.2 NOT USED

3.2.12.3 Connection to Liquid Lines

Tubing for connection of sensing elements and transmitters to liquid and steam lines shall be copper with brass compression fittings.

3.2.12.4 Connection to Ductwork

Tubing for connection of sensing elements and transmitters to ductwork shall be plastic tubing.

3.2.12.5 Tubing in Concrete

Tubing in concrete shall be installed in rigid conduit. Tubing in walls containing insulation, fill, or other packing materials shall be installed in raceways dedicated to tubing.

3.3 CONTROL SEQUENCES OF OPERATION

3.3.1 System Requirements

These requirements shall apply to all primary HVAC systems unless modified herein. The sequences describe the actions of the control system for one direction of change in the HVAC process analog variable, such as temperature, humidity or pressure. The reverse sequence shall occur when the direction of change is reversed.

3.3.1.1 HVAC System Supply Fan Operating

HVAC system outside-air, return-air, and relief-air dampers shall function as described hereinafter for specific modes of operation. Interlocked exhaust fans shall be stopped in the unoccupied and ventilation delay modes and their dampers shall be closed. Interlocked exhaust fans shall run in the occupied mode, and their dampers shall open. Cooling-coil control valves shall function as described hereinafter for the specific modes of operation. Heating coil valves shall be under control.

3.3.1.2 HVAC System Supply Fan Not Operating

When an HVAC system is stopped, interlocked fans shall stop,the outside-air and relief-air dampers shall close, the return-air damper shall open, all stages of direct-expansion cooling shall stop, the system shall pump down if it has a pump down cycle, humidification shall stop, and cooling-coil valves for coils located indoors shall close to the coil. Cooling-coil valves of units located outdoors shall open to the coil. Heating-coil valves shall remain under control.

3.3.2 NOT USED

3.3.3 Unit-Heater and Cabinet-Unit-Heater

A wall-mounted thermostat with an "AUTO-OFF" switch located as shown, shall cycle the fan to maintain its setpoint as shown when the switch is in the "AUTO" position. When the switch is in the "OFF" position, the fan shall be stopped.

3.3.4 NOT USED

3.3.5 NOT USED

3.3.6 Dual-Temperature Fan-Coil Unit

A wall-mounted thermostat, located as shown, shall cycle the fan to maintain the setpoint as shown. An aquastat shall switch the wall-mounted thermostat action from heating mode to cooling mode whenever the hydronic dual-temperature medium is below the setpoint as shown.

3.3.7 NOT USED

3.3.8 Single Building Hydronic Heating with Hot Water Boiler

a. All Modes - The outside-air temperature controller shall accept a signal at its process variable input from a sunshielded outside-air temperature sensing element and transmitter located as shown. The outside-air temperature controller process variable relay contact output shall start and stop the distribution pumps , boiler pumps and boilers at the outside-air temperatures shown. The analog output of the outside-air temperature controller shall send a signal to the remote setpoint input of the primary hydronic-heating system temperature controller to reset the hydronic-heating supply temperature setpoint in a linear schedule based on the outside-air temperature as shown. The hydronic-heating supply temperature controller shall accept a signal at its process variable input from a temperature sensing element and transmitter located in the hydronic-heating supply line and the controller output shall modulate the hydronic-heating system control valve to maintain the reset schedule setpoint in the hydronic-heating supply line.

b. Occupied Mode - When the timeclock places the system in the occupied mode, a space-temperature sensing element and transmitter located as shown shall signal a space-temperature controller which shall maintain the setpoint as shown by modulating the secondary-hydronic-system zone valve. In this mode of operation, the controller setpoint shall be adjustable from the sensor and transmitter location.

c. Unoccupied Mode - When the timeclock places the system in the unoccupied mode, the setpoint of the controller shall be as shown and shall be adjustable at the HVAC control panel.

3.3.9 through 3.3.15 NOT USED

3.3.16 Bypass Multizone Control Sequence with Return Fan

3.3.16.1 Occupied, Unoccupied, and Ventilation-Delay Modes

Ventilation-delay-mode timing shall start prior to the occupied-mode timing. The timeclock shall close a contact which shall turn on the ventilation-delay pilot light and energize a relay which shall prevent the outside-air damper from opening. At the time shown, the timeclock shall close a contact which shall turn on the occupied-mode pilot light and shall place the system in the occupied mode. At the expiration of the ventilation-delay-mode timing period, the timeclock shall open the contact to turn off the ventilation-delay-mode pilot light and de-energize a relay to allow the outside-air damper to open. At the time shown, the timeclock shall open the contact to turn off the occupied-mode pilot light and shall place the control system in the unoccupied mode of operation.

3.3.16.2 Outside-Air, Return-Air, and Relief-air Dampers

a. Occupied Mode - The outside-air, return-air, and relief-air dampers shall be under mixed-air temperature and economizer control.

b. Unoccupied and Ventilation-Delay Modes - The dampers shall return to their normal positions.

3.3.16.3 Supply-Fan and Return-Fan Control

a. Occupied and Ventilation-Delay Modes - Supply fan and relief fan shall start, and shall operate continuously.

b. Unoccupied Mode - The supply fan and the return fan shall cycle from a night-thermostat. The fans shall start at and stop at the setpoints as shown.

3.3.16.4 Filter

A differential-pressure switch across the filter shall turn on the filter pilot light when the pressure drop across the filter reaches the setpoint as shown.

3.3.16.5 Freeze Protection

All Modes - A freezestat, located as shown, shall stop the supply and relief fans, cause the outside air, return air, and relief air dampers to return to their normal position as shown, and shall turn on the low-temperature pilot light in the HVAC control panel if the temperature drops below the freezestat's setpoint as shown. Return to the normal mode of operation shall require manual reset at the freezestat and at the HVAC control panel.

3.3.16.6 Cold-Deck Coil

a. Occupied and Ventilation-Delay Modes - The control valve shall be modulated by the cooling-coil temperature controller from the signal of a temperature-sensing element and transmitter located in the coil discharge air to maintain the setpoint as shown.

b. Unoccupied Mode - The cooling-coil temperature-controller output signal shall be interrupted and the cooling-coil control valve shall be closed.

3.3.16.7 Economizer Control

An economizer controller shall accept the signal of an outside-air temperature-sensing element and transmitter at its remote setpoint input and shall accept the signal of a return-air temperature-sensing element and transmitter at its process variable input. The economizer controller shall perform switchover between outside-air economizer control mode and minimum outside-air mode. Until the return-air temperature rises above the setpoint as shown, the economizer controller shall hold the system in the minimum-outside-air mode and the economizer pilot light shall be off. When the return-air temperature rises above the setpoint, the economizer controller shall place the control system in the economizer mode or in the minimum-outside-air mode as determined by a comparison of the outside-air and return-air temperatures in accordance with the differential temperature setpoints as shown. When the outside-air temperature is low with respect to the return-air temperature, the control system shall be in the economizer mode and the economizer pilot light shall be on. When the economizer controller places the control system in the minimum-outside-air mode, the outside-air damper shall be open to the setting determined by the minimum-position switch.

3.3.16.8 Mixed-Air Temperature Control

When the economizer controller places the system in the economizer mode, the mixed-air temperature controller shall modulate the dampers from the signal of a temperature-sensing element and transmitter located in the mixed-air stream to maintain the setpoint as shown.

3.3.16.9 Zone Control

All Modes - A space thermostat for each zone shall gradually operate the zone-mixing damper and heating coil to heat and cool its respective zone by mixing cold-deck air and bypass-deck air to maintain the setpoint as shown. On a rise in space temperature the heating coil valve shall gradually close, and after a deadband as shown, the bypass damper shall gradually close, and the cold-deck damper shall gradually open.

3.3.16.10 Emergency Fan Shutdown

Activation of a duct smoke detector in the supply-air or return-air ductwork, or activation of a manual emergency fan shutdown switch shall cause the associated fan to shutdown in accordance with NFPA 90A. Activation of these devices shall operate a pilot light on the HVAC control panel. The panel shall require manual resetting after the detector and the manual switch are reset.

3.3.17 NOT USED

3.3.18 NOT USED

3.3.19 Single-Zone with Hydronic Heating/Cooling Coils No Return Fan

3.3.19.1 Occupied, Unoccupied, and Ventilation-Delay Modes

Ventilation-delay-mode timing shall start prior to the occupied-mode timing. The timeclock shall close a contact, which shall turn on the ventilation-delay pilot light and energize a relay which shall prevent the outside-air damper from opening. At the time shown, the timeclock shall close a contact which shall turn on the occupied-mode pilot light and shall place the system in the occupied mode. At the expiration of the ventilation-delay-mode timing period, the timeclock shall open the contact to turn off the ventilation-delay-mode pilot light and de-energize a relay to allow the outside-air damper to open. At the time shown, the timeclock shall open the contact to turn off the occupied-mode pilot light and shall place the control system in the unoccupied mode of operation.

3.3.19.2 Outside-Air, Return-Air, and Relief-Air Dampers

a. Occupied Mode - The outside-air, return-air, and relief-air dampers shall be under space temperature and economizer control.

b. Unoccupied and Ventilation-Delay Modes - The dampers shall return to their normal positions.

3.3.19.3 Supply-Fan Control

a. Occupied and Ventilation-Delay Modes - Supply fan shall start, and shall operate continuously.

b. Unoccupied Mode - The supply fan shall cycle from a night thermostat. The fan shall start at and stop at the setpoints as shown.

3.3.19.4 Filter

A differential-pressure switch across the filter shall turn on the filter pilot light when the pressure drop across the filter reaches the setpoint as shown.

3.3.19.5 Freeze Protection

All Modes - A freezestat, located as shown, shall stop the supply fan, cause the outside air, return air, and relief air dampers to return to their normal position as shown, and shall turn on the low-temperature pilot light in the HVAC control panel if the temperature drops below the freezestat's setpoint as shown. Return to the normal mode of operation shall require manual reset at the freezestat and at the HVAC control panel.

3.3.19.6 Hydronic Cooling Coil

a. Occupied and Ventilation-Delay Modes - The control valve shall be modulated by the space-temperature controller.

b. Unoccupied Mode - The space-temperature controller output signal shall be interrupted and the cooling-coil control valve shall be closed.

3.3.19.7 Economizer Control

An economizer controller shall accept the signal of an outside-air temperature-sensing element and transmitter at its remote setpoint input and shall accept the signal of a return-air temperature-sensing element and transmitter at its process variable input. The economizer controller shall perform switchover between outside-air economizer control mode and minimum outside-air mode. Until the return-air temperature rises above the setpoint as shown, the economizer controller shall hold the system in the minimum-outside-air mode and the economizer pilot light shall be off. When the return-air temperature rises above the setpoint, the economizer controller shall place the control system in the economizer mode or in the minimum-outside-air mode as determined by a comparison of the outside-air and return-air temperatures in accordance with the differential temperature setpoints as shown. When the outside-air temperature is low with respect to the return-air temperature, the control system shall be in the economizer mode and the economizer pilot light shall be on. When the economizer controller places the control system in the minimum-outside-air mode, the outside-air damper shall be open to the setting determined by the minimum-position switch.

3.3.19.8 Space-Temperature-Sequenced Heating and Cooling Control

A space-temperature sensing element and transmitter operating through a space-temperature controller shall maintain the setpoint by sequencing the valves and dampers as shown. On a rise in space temperature, the space-temperature controller shall first gradually close the heating-coil valve. After the controller output passes through a deadband, the controller shall then gradually operate the outside-air damper to admit outside air beyond the minimum quantity, except that when the economizer controller places the system in the minimum-outside-air mode, the outside-air damper shall be open to the setting as determined by the minimum-position switch. The mixed air sensor and controller acting through a low signal selector insures that the mixed air temperature does not drop below the setpoint of 55E F. After the outside-air damper is fully open, upon a further rise in space temperature, the controller shall then gradually open the cooling-coil valve to maintain the setpoint as shown.

3.3.19.9 Emergency Fan Shutdown

Activation of a duct smoke detector in the supply-air or return-air ductwork, or activation of a manual emergency fan shutdown switch shall cause the associated fan to shutdown in accordance with NFPA 90A. Activation of these devices shall operate a pilot light on the HVAC control panel. The panel shall require manual resetting after the detector and the manual switch are reset.

SAFETY PAYS

3.3.20 NOT USED

3.3.21 NOT USED

3.3.22 Single-Zone - Hydronic Heating and Direct-Expansion Cooling Coils

3.3.22.1 Occupied, Unoccupied, and Ventilation-Delay Modes

Ventilation-delay mode timing shall start prior to the occupied-mode timing. The timeclock shall close a contact, which shall turn on the ventilation-delay pilot light and energize a relay which shall prevent the outside-air damper from opening. At the time shown, the timeclock shall close a contact which shall turn on the occupied-mode pilot light and shall place the system in the occupied mode. At the expiration of the ventilation-delay-mode timing period, the timeclock shall open the contact to turn off the ventilation-delay mode pilot light and de-energize a relay to allow the outside-air damper to open. At the time shown, the timeclock shall open the contact to turn off the occupied-mode pilot light and shall place the control system in the unoccupied mode of operation.

3.3.22.2 Outside-Air, Return-Air, and Relief-Air Dampers

a. Occupied Mode - The outside-air, return-air, and relief-air dampers shall be under mixed-air temperature and economizer control.

b. Unoccupied and Ventilation-Delay Modes - The dampers shall return to their normal positions as shown.

3.3.22.3 Supply-Fan Control

a. Occupied and Ventilation-Delay Modes - Supply fan shall start, and shall operate continuously.

b. Unoccupied Mode - The supply fan shall cycle from a night-thermostat. The fan shall start at and stop at the setpoints as shown.

3.3.22.4 Filter

A differential-pressure switch across the filter shall turn on the filter pilot light when the pressure drop across the filter reaches the setpoint as shown.

3.3.22.5 Freeze Protection

All Modes - A freezestat, located as shown, shall stop the supply fan, cause the outside air, return air, and relief air dampers to return to their normal position as shown, and shall turn on the low-temperature pilot light in the HVAC control panel if the temperature drops below the freezestat's setpoint as shown. Return to the normal mode of operation shall require manual reset at the freezestat and at the HVAC control panel.

3.3.22.6 Direct Expansion Cooling Coil

a. Occupied and Ventilation-Delay Modes - The stages of cooling shall be operated by the space-temperature controller.

b. Unoccupied Mode - The space-temperature controller output signal shall be interrupted and cooling shall be off.

3.3.22.7 Economizer Control

An economizer controller shall accept the signal of an outside-air temperature-sensing element and transmitter at its remote setpoint input and shall accept the signal of a return-air temperature-sensing element and transmitter at its process variable input. The economizer controller shall perform switchover between outside-air economizer control mode and minimum-outside-air mode. Until the return-air temperature rises above the setpoint as shown, the economizer controller shall hold the system in the minimum-outside-air mode and the economizer pilot light shall be off. When the return-air temperature rises above the setpoint, the economizer controller shall place the control system in the economizer mode or in the minimum-outside-air mode as determined by a comparison of the outside-air and return-air temperatures in accordance with the differential temperature setpoints as shown. When the outside-air temperature is low with respect to the return-air temperature, the control system shall be in the economizer mode and the economizer pilot light shall be on. When the economizer controller places the control system in the minimum-outside-air mode, the outside-air damper shall be open to the setting determined by the minimum-position switch.

3.3.22.8 Space-Temperature-Sequenced Heating and Cooling Control

A space-temperature sensing element and transmitter operating through a space-temperature controller shall maintain the setpoint by sequencing the heating coil valve, dampers, and stages of DX cooling as shown. On a rise in space temperature, the controller shall first gradually close the heating-coil valve. After the controller output passes through a deadband, the controller shall then gradually operate the outside-air damper to admit outside air beyond the minimum quantity, except that when the economizer controller places the system in the minimum-outside-air mode, the outside-air damper shall be open to the setting as determined by the minimum-position switch. The mixed air sensor and controller acting through a low signal selector insures that the mixed air temperature does not drop below the setpoint of 55E F. After the outside-air damper is fully open, upon a further rise in space temperature, the controller shall then operate the stages of cooling in sequence to maintain the setpoint as shown.

3.3.22.9 Emergency Fan Shutdown

Activation of a duct smoke detector in the supply-air or return-air ductwork, or activation of a manual emergency fan shutdown switch shall cause the associated fan to shutdown in accordance with NFPA 90A. Activation of these devices shall operate a pilot light on the HVAC control panel. The panel shall require manual resetting after the detector and the manual switch are reset.

3.4 COMMISSIONING PROCEDURES

3.4.1 General Procedures

3.4.1.1 Evaluations

The Contractor shall make the observations, adjustments, calibrations, measurements, and tests of the control systems, tune the controllers, set the timeclock schedule, and make any necessary control-system corrections to ensure that the systems function as described in paragraph CONTROL SEQUENCES OF OPERATION. The Contractor shall permanently record, on system equipment schedule, the final setting of controller proportional, integral and derivative constant settings, setpoint, manual reset setting, maximum and minimum controller output, and ratio and bias settings, in units and terminology specific to the controller.

3.4.1.2 Item Check

An item-by-item check of the sequence of operation requirement shall be performed using Steps 1 through 4 in the specified control system commissioning procedures. Steps 1, 2, and 3 shall be performed with the HVAC system shutdown; Step 4 shall be performed after the HVAC systems have been started. Signals used to change the mode of operation shall originate from the actual HVAC control device intended for the purpose, such as the time clock.

External input signals to the HVAC control panel (such as EMCS, starter auxiliary contacts, and external systems) may be simulated in Steps 1, 2, and 3. With each operational-mode change signal, pilot lights and HVAC-panel output-relay contacts shall be observed to ensure that they function. All terminals assigned to EMCS shall be checked and observed to ensure that the proper signals are available.

3.4.1.3 Weather-Dependent Test Procedures

Weather-dependent test procedures that cannot be performed by simulation shall be performed in the appropriate climatic season. When simulation is used, the Contractor shall verify the actual results in the appropriate season.

3.4.1.4 Configuration

The Contractor shall configure each controller for its specified service.

3.4.1.5 Two-Point Accuracy Check

A two-point accuracy check of the calibration of each HVAC-control-system sensing element and transmitter shall be performed by comparing the HVAC-control-panel readout to the actual value of the variable measured at the sensing element and transmitter or airflow measurement station location. Digital indicating test instruments shall be used, such as digital thermometers, motor-driven psychrometers, and tachometers. The test instruments shall be at least twice as accurate as the specified sensing element-to-controller readout accuracy. The calibration of the test instruments shall be traceable to NIST standards. The first check point shall be with the HVAC system in the shutdown condition, and the second check point shall be with the HVAC system in an operational condition. Calibration checks shall verify that the sensing element-to-controller readout accuracies at two points are within the specified product accuracy tolerances. If not, the device shall be recalibrated or replaced and the calibration check repeated.

3.4.1.6 Insertion, Immersion Temperature

Insertion-temperature and immersion-temperature sensing element and transmitter-to-controller readout calibration accuracy shall be checked at one physical location along the axis of the sensing element.

3.4.1.7 Averaging Temperature

Averaging-temperature sensing element and transmitter-to-controller readout calibration accuracy shall be checked every 1/2 meter along the axis of the sensing element in the proximity of the sensing element, for a maximum of 10 readings. These readings shall then be averaged.

3.4.1.8 Controller Stations

The Contractor shall use the controllers' MANUAL/AUTOMATIC stations as the means of manipulating control devices, such as dampers and valves, to check IP operation and to effect stable conditions prior to making measurement checks.

3.4.1.9 Controller-Tuning Procedure

The Contractor shall perform a controller-tuning procedure, which shall consist of setting the initial proportional, integral, and derivative (PID) mode constants, controller setpoints, and logging the settings. Tuning shall be self-tuning operation by the controller unless manual tuning is necessary.

3.4.1.10 Controller Manual-Tuning Procedure

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Where required, the controller manual-tuning procedure shall be performed in three steps. Using a constant-temperature-setpoint controller as an example, these steps are:

a. Step A:

(1) The controller MANUAL/AUTO station shall be indexed to the AUTO position and the integral- and derivative-mode constants set to zero.

(2) The proportional-mode constant shall be set to an initial setting of 8 percent. (This corresponds to 18.6 kPa per degree C or 3.6 ma per degree C proportional controller output change for a 55.5 degree C transmitter span.) This causes the controller output signal to vary from live zero output to full output for an input signal change representing an 4.5 degree C change.

(3) Controllers for other variables, such as relative humidity and static pressure, shall have their proportional-mode constants set initially in a similar manner for an achievable output range proportional to the transmitter span.

b. Step B:

(1) The controller temperature setpoint shall be set at any achievable temperature. The controller output and transmitter input shall be observed.

(2) If the transmitter input continuously oscillates above and below the setpoint without settling at a fixed value, or if such oscillation increases, the proportional-mode constant is too small.

(3) If the proportional-mode constant is too small, increase it in steps until the transmitter input indicates stable control at any temperature, provided that the controller output is not at either extreme of the output range.

(4) If the temperature control point slowly drifts toward or away from the controller setpoint, the proportional-mode constant is too large. Its setting shall be decreased in steps until oscillations occur as described in the preceding paragraphs, and then the setting shall be increased until stable control occurs.

(5) A step change in controller setpoint shall be introduced. This should cause the controller to overshoot the setpoint slightly, with each subsequent overshoot peak value decreasing by a factor of 2/3 until stable control is achieved at, above, or below the setpoint.

(6) Next, the integral-mode constant setting shall be increased in small steps, and setpoint changes shall be introduced until control point and controller setpoint coincide at stable control. This should happen consistently after a setpoint change within a short time, such as 5 to 10 minutes.

c. Step C:

(1) Unless the HVAC process variable changes rapidly, the derivative-mode constant setting can remain at zero.

(2) If derivative control is needed, the derivative-mode constant shall be gradually increased.

(3) Step changes in controller setpoint shall be introduced, and the derivative-mode constant setting adjusted until stable control is achieved.

3.4.1.11 Setting the Controller

After the controller manual-tuning procedure is complete, the controller shall be set at the setpoint as shown.

3.4.2 NOT USED

3.4.3 Unit Heater and Cabinet Unit Heater

The "OFF/AUTO" switch shall be placed in the "OFF" position. Each space-thermostat temperature setting shall be turned up so that it makes contact to turn on the unit-heater fans. The unit-heater fans shall not start. The "OFF/AUTO" switch shall be placed in the "AUTO" position. The unit-heater fans shall start. Each space-thermostat temperature setting shall be turned down, and the unit-heater fans shall stop. The thermostats shall be set at their temperature setpoints as shown. The results of testing of one of each type of unit shall be logged.

3.4.4 NOT USED

3.4.5 NOT USED

3.4.6 Fan-Coil-Unit

The dual-temperature hydronic system shall be set to heating. Each space thermostat temperature setting shall be turned up so that it makes contact and turns the fan-coil unit on. The fan-coil unit fan shall start. Each space thermostat temperature setting shall be turned down and the fan-coil unit fans shall stop. The dual-temperature hydronic system shall be switched to cooling. Each space thermostat temperature setting shall be turned up; contact shall be broken and the fan-coil unit fans shall stop. Each space thermostat temperature setting shall be turned down. The fan-coil unit fans shall start. The thermostats shall be set at the temperature setpoints as shown. The results of testing of one of each type of unit shall be logged.

3.4.7 NOT USED

3.4.8 Single Building Hydronic-Heating with Hot Water Boiler

Steps for installation shall be as follows:

a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. It shall be verified that power and main air are available at the HVAC system control panel.

b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature-sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for outside-air temperature and system-supply temperature shall be checked.

c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all valves shall be verified visually. The signal shall be varied from live zero of 4 ma to 20 ma, and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other. Example: NC actuators are closed at 4 ma and are open at 20 ma. The signal levels that move the controlled device to its extreme positions shall be logged.

d. Step 4 - Control-System Commissioning:

(1) The outside-air temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position and the two-point calibration sensing element-to-controller readout accuracy check for the outside-air temperature performed. The controller proportional band adjustment, the setpoint, the manual reset, and the maximum controller output shall be set to achieve the outside-air temperature schedule as shown.

(2) A signal shall be applied to simulate that the outside-air temperature is above the setpoint as shown. It shall be verified that pumps and boiler stop. A signal shall be applied to simulate that the outside-air temperature is below the setpoint as shown. It shall be verified that pumps start and boiler operates.

(3) The system's supply-temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the two-point calibration accuracy check of the sensing element-to-controller readout for the system-supply temperature performed. The controller shall be placed in the remote-setpoint mode. The remote setpoint for temperature schedule shall be set as shown. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller setup and tuning procedures performed. The controller shall be set at a system-supply temperature setpoint within the schedule as shown and the mode-constant setpoints logged. Signals of 8 ma and 16 ma shall be sent to the remote setpoint from the outside-air temperature controller, to verify that the controller setpoint changes to the appropriate values. The outside-air temperature controller's "MANUAL/AUTO" station shall be indexed to "AUTO."

(4) An occupied-mode signal shall be applied. Each space-temperature controller "MANUAL/AUTO" station shall be indexed to "MANUAL." The calibration accuracy check of sensing element-to-controller readout for each space temperature shall be performed, and the values logged. The controller shall be placed in the remote-setpoint mode. The setpoint low-end limit shall be set to 19 degrees Cand the high-end limit shall be set to 22 degrees C.The proper action of the temperature-setpoint device at the space-temperature sensing element and transmitter location shall be verified. Each controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position and the controller-tuning procedure performed. An unoccupied-mode signal shall be applied and it shall be verified that each controller's setpoint changes to the unoccupied-mode setting. The temperature setpoint device shall be set to the space-temperature setpoint as shown.

3.4.9 through 3.4.15 NOT USED

3.4.16 Bypass Multizone with Return Fan

Steps for installation shall be as follows:

a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. Power and main air shall be available at the HVAC system control panel. The outside-air and relief-air dampers shall be closed, the return-air damper open, and the cooling-coil valve closed.

b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature-sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for outside-air, return-air, mixed-air, and cold-deck-air temperatures shall be checked.

c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator, using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all dampers and valves shall be verified. The signal shall be varied from live zero of 4 ma or 21 kPa to 20 ma or 103 kPa, and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced and parallel-operated actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other.

d. Step 4 - Control-System Commissioning:

(1) With the fans ready to start, the ventilation-delay-mode signal shall be applied, and it shall be verified that the ventilation-delay-mode pilot light turns on. The occupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns on and that supply fan and relief fan start. It shall be verified that the outside-air and relief-air dampers are closed, the return-air damper is open, and the heating and cooling-coil valves are under control, by slightly changing the controller outputs. The ventilation-delay-mode signal shall be released, and it shall be verified that the ventilation-delay-mode pilot light turns off, and that the outside-air, return-air, and relief-air dampers come under control, by changing the controller output.

(2) The minimum-outside-air-mode signal shall be applied. It shall be verified that the outside-air damper opens to minimum position and that the economizer pilot light is off.

(3) The mixed-air temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position. An economizer-mode input signal shall be simulated and it shall be verified that the economizer-mode pilot light turns on. The mixed-air temperature controller output shall be changed to slightly open the outside-air damper and the second point of the two-point calibration accuracy check of sensing element-to-controller readout for outside-air, return-air, and mixed-air temperatures shall be performed. The controller-tuning procedure shall be performed. The mixed-air temperature controller "MANUAL/AUTO" switch shall be indexed to the "AUTO" position. The mixed-air temperature controller shall be placed in the local setpoint mode and set at the temperature setpoint as shown.

(4) The cold-deck temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the calibration accuracy check of sensing element-to-controller readout shall be performed. The controller shall be placed in the local-setpoint mode, and set at the temperature setpoint as shown. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller-tuning procedure performed.

(5) An unoccupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns off, the HVAC system shuts down, and the control system assumes the specified shutdown conditions. The night-thermostat temperature setting shall be turned upward, and it shall be verified that the HVAC system starts; the setting shall be turned downward, and it shall be verified that the HVAC system stops. The night thermostat shall be set at the setpoint as shown.

(6) With the HVAC system running, a filter differential-pressure switch input signal shall be simulated at the device. It shall be verified that the filter pilot light turns on, and that contact output at the EMCS terminals is made. The differential-pressure switch shall be set at the setpoint as shown.

(7) With the HVAC system running, a freezestat trip input signal shall be simulated at the device. HVAC system shutdown shall be observed. It shall be verified that the low-temperature pilot light turns on, and that contact output at the EMCS terminals is made. The freezestat shall be set at the setpoint as shown. The HVAC system shall be restarted by manual restart and it shall be verified that the pilot light turns off.

(8) With the HVAC system running, a smoke-detector trip input signal shall be simulated at each detector, and control-device actions and interlock functions as described in paragraph CONTROL SEQUENCES OF OPERATION shall be verified. Simulation shall be performed without false-alarming any Life Safety systems. It shall be verified that the HVAC system shuts down and that the smoke-detector pilot light turns on, and contact output at the EMCS terminals is made. The detectors shall be reset. The HVAC system shall be restarted by manual restart, and it shall be verified that the pilot light turns off.

(9) The setpoint of each zone thermostat shall be changed and correct operation of the zone damper and the heating coil valve shall be verified for each zone. Each zone thermostat shall be calibrated and set at its setpoint as shown.

SAFETY PAYS

3.4.17 NOT USED

3.4.18 NOT USED

3.4.19 Single-Zone with Hydronic Heating and Cooling Coils; No Return Fan

Steps for installation shall be as follows:

a. Step 1 - System Inspection: The HVAC system shall be verified in its shutdown condition. Power and main air shall be available at the HVAC system control panel. The outside-air and relief-air dampers shall be closed, the return-air damper shall be open, and the cooling-coil valve shall be closed.

b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature-sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for outside-air, return-air, and space temperatures shall be checked.

c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator, using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all dampers and valves shall be verified. The signal shall be varied from live zero of 4 ma to 20 ma, and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced and parallel-operated actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other.

d. Step 4 - Control-System Commissioning:

(1) With the fan ready to start, the ventilation-delay-mode signal shall be applied, and it shall be verified that the ventilation-delay-mode pilot light turns on. The occupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns on and that supply fan starts. It shall be verified that the outside-air and relief-air dampers are closed, the return-air damper is open, and the heating-coil and cooling-coil valves are under control, by slightly changing the controller outputs. The ventilation-delay-mode signal shall be released, and it shall be verified that the ventilation-delay-mode pilot light turns off and that the outside-air, return-air, and relief-air dampers come under control by changing the controller output.

(2) The minimum-outside-air-mode signal shall be applied. It shall be verified that the outside-air damper opens to minimum position and the economizer pilot light is off.

(3) The space-temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position. An economizer-mode input signal shall be simulated and it shall be verified that the economizer-mode pilot light turns on. The space-temperature controller output shall be changed and the second point of the two-point calibration accuracy check of sensing element-to-controller readout for outside-air, return-air, and space temperatures shall be performed. The controller shall be placed in the remote-setpoint mode. The setpoint low-end limit shall be set to 19 degrees Cand the high-end limit shall be set to 22 degrees C. Proper operation of the temperature setpoint device at the space-temperature sensing element and transmitter location shall be verified. The space-temperature controller tuning procedure shall be performed. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position and the temperature setpoint device shall be set to the space temperature setpoint as shown. A change in space temperature shall be simulated and it shall be verified that the heating-coil valve and the cooling-coil valve operate in sequence as shown.

(4) An unoccupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns off, the

HVAC system shuts down, and the control system assumes the specified shutdown conditions. The night-thermostat temperature setting shall be turned upward, and it shall be verified that the HVAC system starts; the setting shall be turned downward, and it shall be verified that the HVAC system stops. The night thermostat shall be set at the setpoint as shown.

(5) With the HVAC system running, a filter differential-pressure switch input signal shall be simulated at the device. It shall be verified that the filter pilot light turns on, and that contact output at the EMCS terminals is made. The differential-pressure switch shall be set at the setpoint as shown.

(6) With the HVAC system running, a freezestat trip input signal shall be simulated at the device. HVAC system shutdown shall be verified, the low-temperature pilot light shall turn on, and contact output at the EMCS terminals shall be verified. The freezestat shall be set at the setpoint as shown. The HVAC system shall be restarted by manual restart, and it shall be verified that the pilot light turns off.

(7) With the HVAC system running, a smoke-detector trip input signal shall be simulated at each detector, and control-device actions and interlock functions, as described in paragraph CONTROL SEQUENCES OF OPERATION shall be verified. Simulation shall be performed without false-alarming any Life Safety systems. It shall be verified that the HVAC system shuts down and that the smoke-detector pilot light turns on, and contact output at the EMCS terminals is made. The detectors shall be reset. The HVAC system shall be restarted by manual restart, and it shall be verified that the pilot light turns off.

3.4.20 NOT USED

3.4.21 NOT USED

3.4.22 Single-Zone with Hydronic-Heating, Direct-Expansion Cooling

Steps for installation shall be as follows:

a. Step 1 - System Inspection: The HVAC system shall be verified in its shutdown condition. Power and main air shall be available at the HVAC system control panel. The outside-air and relief-air dampers shall be closed, the return-air damper shall be open, and all stages of cooling shall be off.

b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature-sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for outside-air, return-air, and space temperatures shall be checked.

c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator, using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all dampers and valves shall be verified. The signal shall be varied from live zero of 4 ma to 20 ma, and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced and parallel-operated actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other. The signal levels that move the controlled device to its extreme positions shall be logged. The operating points of the sequence shall be set for each stage of cooling and the proper operation of each stage shall be verified.

d. Step 4 - Control-System Commissioning:

(1) With the fan ready to start, the ventilation-delay-mode signal shall be applied, and it shall be verified that the

ventilation-delay-mode pilot light turns on. The occupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns on and that supply fan starts. It shall be verified that the outside-air and relief-air dampers are closed, the return-air damper is open, and the heating-coil and stages of cooling are under control, by slightly changing the controller output. The ventilation-delay-mode signal shall be released, and it shall be verified that the ventilation-delay-mode pilot light turns off and that the outside-air, return-air, and relief-air dampers come under control by changing the controller output.

(2) The minimum-outside-air-mode signal shall be applied. It shall be verified that the outside-air damper opens to minimum position and the economizer pilot light is off.

(3) The space-temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the calibration accuracy check for sensing element-to-controller readout performed. The controller shall be placed in the remote-setpoint mode. The setpoint low-end limit shall be set to 19 degrees Cand the high-end limit shall be set to 22 degrees C. Proper operation of the temperature setpoint device at the space-temperature sensing element and transmitter location shall be verified. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller-tuning procedure shall be performed. The temperature setpoint device shall be set to the space temperature setpoint as shown. A change in space temperature shall be simulated and it shall be verified that the heating-coil valve and the stages of D/X cooling operate in sequence as shown.

(4) An unoccupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns off, the HVAC system shuts down, and the control system assumes the specified shutdown conditions. The night-thermostat temperature setting shall be turned upward, and it shall be verified that the HVAC system starts; the setting shall be turned downward, and it shall be verified that the HVAC system stops. The night thermostat shall be set at the setpoint as shown.

(5) With the HVAC system running, a filter differential-pressure switch input signal shall be simulated at the device. It shall be verified that the filter pilot light turns on, and that contact output at the EMCS terminals is made. The differential-pressure switch shall be set at the setpoint as shown.

(6) With the HVAC system running, a freezestat trip input signal shall be simulated at the device. HVAC system shutdown shall be verified; the low-temperature pilot light shall turn on, and contact output at the EMCS terminals shall be verified. The freezestat shall be set at the setpoint as shown. The HVAC system shall be restarted by manual restart, and it shall be verified that the pilot light turns off.

(7) With the HVAC system running, a smoke-detector trip input signal shall be simulated at each detector, and control-device actions and interlock functions as described in paragraph CONTROL SEQUENCES OF OPERATION shall be verified. Simulation shall be performed without false-alarming any Life Safety systems. It shall be verified that the HVAC system shuts down and that the smoke-detector pilot light turns on, and contact output at the EMCS terminals is made. The detectors shall be reset. The HVAC system shall be restarted by manual restart, and it shall be verified that the pilot light turns off.

3.5 BALANCING, COMMISSIONING, AND TESTING

3.5.1 Coordination with HVAC System Balancing

Commissioning of the control system, except for tuning of controllers, shall be performed prior to or simultaneous with HVAC system balancing. The Contractor shall tune the HVAC control system after all air-system and hydronic-system balancing has been completed, minimum damper positions set and a report has been issued.

3.5.2 Control System Calibration, Adjustments, and Commissioning

Control system commissioning shall be performed for each HVAC system, using test plans and procedures previously approved by the Government. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform commissioning and testing of the HVAC control system. All instrumentation and controls shall be calibrated and the specified accuracy shall be verified using test equipment with calibration traceable to NIST standards. Wiring shall be tested for continuity and for ground, open, and short circuits. Tubing systems shall be tested for leaks. Mechanical control devices shall be adjusted to operate as specified. HVAC control panels shall be pretested off-site as a functioning assembly ready for field connections, calibration, adjustment, and commissioning of the operational HVAC control system. Written notification of any planned commissioning or testing of the HVAC Control systems shall be given to the Government at least 14 calendar days in advance.

3.5.3 Performance Verification Test

The Contractor shall demonstrate compliance of the HVAC control system with the contract documents. Using test plans and procedures previously approved by the Government, the Contractor shall demonstrate all physical and functional requirements of the project. The performance verification test shall show, step-by-step, the actions and results demonstrating that the control systems perform in accordance with the sequences of operation. The performance verification test shall not be started until after receipt by the Contractor of written permission by the Government, based on Government approval of the commissioning report and completion of balancing. The tests shall not be conducted during scheduled seasonal off-periods of base heating and cooling systems.

3.5.4 Posted and Panel Instructions

Posted and panel instructions, showing the final installed conditions, shall be provided for each system. The posted instructions shall consist of half-size laminated drawings and shall include the control system schematic, equipment schedule, ladder diagram, sequence of operation, panel arrangement drawings, wiring diagram, and valve and damper schedules. The posted instructions shall be permanently affixed, by mechanical means, to a wall near the control panel. Panel instructions shall consist of laminated letter-size sheets and shall include a routine maintenance checklist and controller configuration check sheets with final configuration record for each controller. Panel instructions and one copy of the operation and maintenance manuals, previously described herein, shall be placed inside each control panel.

3.6 TRAINING

3.6.1 Training-Course Requirements

A training course shall be conducted for 4 operating staff members designated by the Contracting Officer. The training period, for a total of 32 hours of normal working time, shall be conducted within 30 days after successful completion of the performance verification test. The training course shall be conducted at the project site. Audiovisual equipment and 4 sets of all other training materials and supplies shall be provided by the Contractor. A training day is defined as 8 hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. The Contractor shall submit an outline for the course, with proposed time schedule. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the start of the training.

3.6.2 Training-Course Content

For guidance in planning the required instruction, the Contractor shall assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the operating and maintenance instructions, the layout and location of each HVAC control panel, the layout of one of each type of unitary equipment and the locations of each, the location of each system-control device external to the panels, preventive maintenance, troubleshooting, diagnostics, calibration, adjustment, commissioning, tuning, and

repair procedures. Typical systems and similar systems may be treated as a group, with instruction on the physical layout of one such system. The results of the performance verification test and the calibration, adjustment and commissioning report shall be presented as benchmarks of HVAC control-system performance by which to measure operation and maintenance effectiveness.

--END OF SECTION--

SECTION 15950

HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS

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1.2 GENERAL REQUIREMENTS 15950- 2
1.3 SUBMITTALS 15950- 2
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1.6 MAINTENANCE AND REPAIR MANUAL 15950- 7

PART 2 PRODUCTS 15950- 7
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SUBMITTAL REGISTER (ER415-1-10)	CONTRACT NO.
TITLE AND LOCATION Discom Barracks Complex, Phase I Ft. Campbell, Kentucky	CONTRACTOR / SPEC. SECTION 15950

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-01 Data										
			Equipment Compliance Booklet; GA.										
			SD-04 Drawings										
			HVAC Control System; GA.										
			SD-08 Statements										
			Performance Verification Test Procedures; GA.										
			Training Course Materials; GA.										
			SD-09 Reports										
			Commissioning Report; GA.										
			Performance Verification Test Report; GA.										
			SD-18 Records										
			Service Organizations; GA.										
			SD-19 Operation and Maintenance Manuals										
			Operation Manual; GA.										
			Maintenance and Repair Manual; GA.										

SAFETY PAYS

SECTION 15990

TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S1.4 (1983; S1.4A) Sound Level Meters

ANSI S1.11 (1986; R 1993) Octave-Band and Fractional-Octave-Band Analog and Digital Filters

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 111 (1988) Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (1989) National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB-01 (1991) Procedural Standards for Testing Adjusting Balancing of Environmental Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (1996) Installation of Air Conditioning and Ventilating Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA-07 (1993) HVAC Systems - Testing, Adjusting and Balancing

1.2 GENERAL REQUIREMENTS

The Contractor shall select AABC MN-1, NEBB-01, SMACNA-07 or ASHRAE 111 as the standard for providing testing, adjusting and balancing of air and water systems. The selected standard shall be used throughout the project. Testing, adjusting, and balancing shall be accomplished by a firm certified for testing and balancing by Associated Air

Balance Council (AABC) or National Environmental Balancing Bureau (NEBB). Prior to testing, adjusting, and balancing, the Contractor shall verify that the systems have been installed and are operating as specified. Approved detail drawings and all other data required for each system and/or component to be tested shall be made available at the jobsite during the entire testing, adjusting and balancing effort. The Contractor shall verify that all balancing devices are properly installed to permit testing, adjusting and balancing and that all duct leakage tests have been completed prior to testing, adjusting and balancing. The Contracting Officer shall be notified in writing of all equipment, components, or balancing devices, that are damaged, incorrectly installed, or missing, as well as any design deficiencies that will prevent proper testing, adjusting, and balancing. Testing, adjusting, and balancing shall not commence until approved by the Contracting Officer. Instrumentation accuracy shall be in accordance with the standard selected in this paragraph.

1.3 INSTRUMENT ACCURACY REQUIREMENTS

All instrumentation shall be checked for accuracy before beginning testing, adjusting and balancing procedures. Instrument accuracy shall be in accordance with the standard selected in paragraph GENERAL REQUIREMENTS. Checks may be carried out against similar equipment maintained specifically for checking purposes or by the manufacturer or a recognized testing facility. All instrumentation used for testing shall be calibrated within 6 months of use. Pitot tubes and U-tube manometers do not require checking. In no case shall the instrumentation accuracy be less than specified by the instrument manufacturer. Any instrument falling out of calibration during the process of balancing and testing shall be recalibrated or removed from the site and replaced by a properly calibrated instrument. No instruments shall be allowed to remain on-site that are not in calibration.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Testing and Balancing; GA.

Three copies of a preliminary report, 30 days before balancing commences. The report shall be organized by specific systems and shall clearly identify each item of equipment to be tested, adjusted, and balanced. The appropriate test procedures and measurements to be taken for each item of equipment shall be listed. Instrument calibration records shall be provided on forms shown in AABC MN-1 or SMACNA-07. Manufacturer's specified accuracy shall be shown. The report shall include floor plans showing all measurement locations and types of measurements to be made. All related data necessary for testing, balancing, and adjusting, including fan curves and pump curves, shall be included. A system readiness checklist, similar to that shown in SMACNA-07, shall be included. The report shall contain a listing of the deficiencies of all systems to be tested, adjusted and balanced and the corrective action taken. The report shall contain a schedule for the testing and balancing. Six copies of the final report on forms shown in AABC MN-1 or SMACNA-07, 30 days after completion of the test and balance operation. Data shall be in a hard bound cover identifying the project name, location, date of submittal, name of Contractor, and a general title indicating the specific area and type of work, and shall be signed by a registered professional engineer, employed by the test and balance firm, who has a minimum of 2 years experience in testing, adjusting and balancing work. The final report shall include a summary describing test methods, test results, and major corrective actions taken. The report shall include as-tested floor plans showing all measurement locations and types of measurements made. The air handling unit data shall include a static pressure profile diagram, and pitot tube traverses where possible. The VAV terminal data shall include maximum and minimum air flows, for design and actual conditions, and shall be supported with summaries which show the air outlet totals for each VAV terminal and the VAV terminal totals for each air handling unit. Air distribution data shall include coded drawings which show the exact location of each air outlet. Pump data shall include pump efficiency. Data for chillers, heating and cooling coils, and heat exchangers, shall include heat balance calculations.

All instruments that are recalibrated and brought back onto the jobsite after being found to be out of calibration shall have recalibration records submitted on forms shown in AABC MN-1 or SMACNA-07.

SD-13 Certificates

Qualification; GA.

Qualification data, 30 days prior to testing and balancing operations. The test and balance firm shall be certified by the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB). The lead balancing technician shall be qualified by AABC or NEBB and his qualification data shall include past experience on at least five similar projects.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 TESTING AND BALANCING

3.1.1 General

The facility shall be essentially complete with final ceiling, walls, windows, doors and partitions in place. Doors and windows surrounding each area to be balanced shall be closed during testing and balancing operations. Air systems shall be complete and operable with balancing dampers, ducting, diffusers, returns, flow control boxes and control components in place. Exhaust fans and fume hoods shall be operational. Hydronic systems shall be complete and operable with balancing valves, flow meters, coils, pumps, piping and control components in place. All measurements and adjustments shall be made using procedures described in standard selected in paragraph GENERAL REQUIREMENTS. Air motion and distribution from air terminals shall be as shown. Smoke tests may be used to demonstrate proper air distribution from air terminals. All data including deficiencies encountered and corrective action taken shall be recorded. If a system cannot be adjusted to meet the design requirements, the Contractor shall promptly notify the Contracting Officer in writing.

3.1.2 Air Systems

Clean filters shall be installed at the beginning of the testing, adjusting, and balancing effort. Each system shall be adjusted until all flow quantities are within plus ten percent and minus zero percent. Dampers shall be checked for tight shutoff. Air leakage around dampers shall be verified. Multizone dampers shall be set for air flow through cooling coils. Fire and smoke dampers shall be open. Fans shall be checked for correct direction of rotation and proper speed shall be verified. Fire and smoke dampers shall be tested at system design air flow to ensure proper closure in accordance with NFPA 90A and manufacturer's instructions prior to building occupancy.

3.1.2.1 General Balancing Methods

In addition to the requirements for specific systems, flows in supply, exhaust and return air systems shall be balanced using the methods in standard selected in paragraph GENERAL REQUIREMENTS. Throttling losses shall be limited. Air flow adjustments shall be made by first adjusting the fan speed to meet the design flow conditions. Fan speed adjustment may not be required for fan motors which are less than 746 W, or if throttling results in no greater than an additional 1/3 W draw above that required if the fan speed were adjusted. Flows and pressures shall be checked in all main risers and supply ducts at all supply, exhaust and return fan discharges. All flows shall be recorded before and after each adjustment.

3.1.2.2 Specific Systems

All special or additional procedures for testing and balancing shall be in accordance with the applicable requirements of the standard selected in paragraph GENERAL REQUIREMENTS. If a system has diversity, only the required quantity of wide open terminals shall be used to meet the design air flow.

3.1.3 Hydronic Systems

All valves and control components shall be open or set as required for maximum system flow. Each system shall be adjusted until all flow quantities are within the tolerances of the standard selected in paragraph GENERAL REQUIREMENTS. Pumps shall be checked for proper speed. Pump activation signal and deactivation signal valves

shall be verified. Pump motor current shall be checked at maximum design flow. Variable speed pumping systems shall be tested at a minimum of four separate flow conditions to simulate design diversity.

3.1.3.1 General Balancing Methods

In addition to the requirements for specific systems, flows in piping, coils and other hydronic system components shall be balanced using the flow meter, equipment pressure drop or pump curve methods in accordance with the applicable provisions of the standard selected in paragraph GENERAL REQUIREMENTS. Flows shall be checked in all main risers and branches and condenser water lines and at all heating and cooling coils, heat exchangers, boilers, chillers, and pump discharges. Pressure taps on all pumps shall be made at factory suction and discharge tappings where available. All flows shall be recorded before and after each adjustment.

3.1.3.2 Specific Systems

Where specific systems require special or additional procedures for testing and balancing, such procedures shall be in accordance with the standard selected in paragraph GENERAL REQUIREMENTS. If a system has diversity, only the required quantity of wide-open terminals shall be used to meet the design water flow.

a. Primary-Secondary: Primary-secondary systems shall be treated as separate systems. Primary systems shall be balanced first with the secondary systems running. Secondary systems shall then be balanced.

b. Summer-Winter: Summer-winter systems shall be balanced in the summer mode of operation. Following completion of the summer-mode balancing, equipment used for winter operation shall be balanced.

c. Four-Pipe Systems: Four-pipe systems shall be considered as two two-pipe systems, and balanced separately. Three-pipe systems shall be balanced by treating each loop separately at its maximum flow.

3.1.4 Marking of Setting

Following final acceptance of certified reports by the Contracting Officer, the setting of all HVAC adjustment devices including valves, splitters, and dampers shall be permanently marked by the testing and balancing engineer so that adjustment can be restored if disturbed at any time.

3.1.5 Marking of Test Ports

The testing and balancing engineer shall permanently and legibly mark and identify the location points of the duct test ports. If the ductwork has exterior insulation, these markings shall be made on the exterior side of the ductwork insulation. All penetrations through ductwork and ductwork insulation shall be properly sealed to prevent air leakage or loss of vapor barrier.

3.2 through 3.6 NOT USED

3.7 CONTROL SYSTEMS

Testing, adjusting, and balancing of the systems shall be coordinated with the control system installation. All control components shall be verified to be properly installed and operating as specified before proceeding with testing, adjusting, and balancing. Verification shall be in accordance with AABC MN-1.

-- End of Section --

SECTION 15990

TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS

PART 1 GENERAL 15990- 1
1.1 REFERENCES 15990- 1
1.2 GENERAL REQUIREMENTS 15990- 1
1.3 INSTRUMENT ACCURACY REQUIREMENTS 15990- 2
1.4 SUBMITTALS 15990- 2

PART 2 PRODUCTS (Not Applicable) 15990- 3

PART 3 EXECUTION 15990- 3
3.1 TESTING AND BALANCING 15990- 3
3.7 CONTROL SYSTEMS 15990- 4

SUBMITTAL REGISTER (ER415-1-10)	CONTRACT NO.
TITLE AND LOCATION Discom Barracks Complex, Phase I Ft. Campbell, Kentucky	CONTRACTOR
	SPEC. SECTION 15990

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.4 SUBMITTALS										
			SD-09 Reports										
			Testing and Balancing; GA.										
			SD-13 Certificates										
			Qualification; GA.										

SAFETY PAYS

SECTION 15995

COMMISSIONING OF HVAC SYSTEMS

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals with "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Commissioning Team; GA.

List of team members who will represent the Contractor in the pre-commissioning checks and functional performance testing, at least 2 weeks prior to the start of pre-commissioning checks. Proposed revision to the list, prior to the start of the impacted work.

SD-06 Instructions

Test Procedures; GA.

Detailed procedures for pre-commissioning checks and functional performance tests, at least 4 weeks prior to the start of pre-commissioning checks.

SD-07 Schedules

Test Schedule; GA.

Schedule for pre-commissioning checks and functional performance tests, at least 2 weeks prior to the start of pre-commissioning checks.

SD-09 Reports

Test Reports; GA.

Completed pre-commissioning checklists and functional performance test checklists organized by system and by subsystem and submitted as one package. The results of failed tests shall be included along with a description of the corrective action taken.

1.2 SEQUENCING AND SCHEDULING

The work described in this Section shall begin only after all work required in related Sections, including Section 15950 HEATING, VENTILATING, AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS and Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS, has been successfully completed, and all test and inspection reports and operation and maintenance manuals required in these Sections have been submitted and approved.

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PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 COMMISSIONING TEAM AND CHECKLISTS

The Contractor shall designate team members to participate in the pre-commissioning checks and the functional performance testing specified herein. In addition, the Government will be represented by a representative of the Contracting Officer, the Design Agent's Representative, and the Using Agency. The team members shall be as follows:

Designation	Function
Q	Contractor's Chief Quality Control Representative
M	Contractor's Mechanical Representative
E	Contractor's Electrical Representative
T	Contractor's Testing, Adjusting, and Balancing Representative
C	Contractor's Controls Representative
D	Design Agent's Representative
O	Contracting Officer's Representative
U	Using Agency's Representative

Each checklist shown in appendices A and B shall be completed by the commissioning team. Acceptance by each commissioning team member of each pre-commissioning checklist item shall be indicated by initials and date unless an "X" is shown indicating that participation by that individual is not required. Acceptance by each commissioning team member of each functional performance test checklist shall be indicated by signature and date.

3.2 TESTS

The pre-commissioning checks and functional performance tests shall be performed in a manner which essentially duplicates the checking, testing, and inspection methods established in the related Sections. Where checking, testing, and inspection methods are not specified in other Sections, methods shall be established which will provide the information required. The Contractor shall provide all materials, services, and labor required to perform the pre-commissioning checks and functional performance tests. A pre-commissioning check or functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating non-Government commissioning team member of which participation is specified is not present for the test. The Contractor shall reimburse the Government for all costs associated with effort lost due to tests that are aborted. These costs shall include salary, travel costs and per diem (where applicable) for Government commissioning team members.

3.2.1 Pre-Commissioning Checks

Pre-commissioning checks shall be performed for the items indicated on the checklists in Appendix A. Deficiencies discovered during these checks shall be corrected and retested in accordance with the applicable contract requirements.

3.2.2 Functional Performance Tests

Functional performance tests shall be performed for the items indicated on the checklists in Appendix B. Functional performance tests shall begin only after all pre-commissioning checks have been successfully completed. Tests shall prove all modes of the sequences of operation, and shall verify all other relevant contract requirements. Tests shall begin with equipment or components and shall progress through subsystems to complete systems. Upon failure of any functional performance test checklist item, the Contractor shall correct all deficiencies in accordance with the applicable contract requirements. The checklist shall then be repeated until it has been completed with no errors.

SAFETY PAYS

APPENDIX A

15995-4

SAFETY PAYS

PRE-COMMISSIONING CHECKLISTS

Pre-commissioning checklist - Piping

For All Piping Systems

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Piping complete.	___	___	X	___	X	___	___	___
b. As-built shop drawings submitted.	___	___	X	___	X	___	___	___
c. Piping flushed and cleaned.	___	___	X	___	X	___	___	___
d. Strainers cleaned.	___	___	X	___	X	___	___	___
e. Valves installed as required.	___	___	X	___	X	___	___	___
f. Piping insulated as required.	___	___	X	___	X	___	___	___
g. Thermometers and gauges installed as required.	___	___	X	___	X	___	___	___
h. Verify operation of valves.	___	___	X	___	___	___	___	___
i. Air vents installed as specified.	___	___	X	X	X	___	___	___
j. Flexible connectors installed as specified.	___	___	X	X	X	___	___	___
k. Verify that piping has been labeled and valves identified as specified.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. Hydrostatic test complete.	___	___	X	___	X	___	___	___
b. TAB operation complete.	___	___	X	___	___	___	___	___

SAFETY PAYS

Pre-commissioning Checklist - Ductwork

For All Air Systems

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Ductwork complete.	___	___	X	___	X	___	___	___
b. As-built shop drawings submitted.	___	___	X	___	X	___	___	___
c. Ductwork leak test complete.	___	___	X	___	X	___	___	___
d. Fire dampers, smoke dampers, and access doors installed as required.	___	___	X	___	X	___	___	___
e. Ductwork insulated as required.	___	___	X	___	X	___	___	___
f. Thermometers and gauges installed as required.	___	___	___	___	___	___	___	___
g. Verify open/closed status of dampers.	___	___	X	___	X	___	___	___
h. Verify smoke dampers operation.	___	___	X	___	___	___	___	___
i. Flexible connectors installed as specified.	___	___	X	___	X	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. TAB operation complete.	___	___	X	___	X	___	___	___

SAFETY PAYS

Pre-commissioning Checklist - Bypass Multizone Air Handling Unit

For Each Bypass Multizone Air Handling Unit:

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Vibration isolation devices installed and freed to float with adequate movement and seismic restraint as specified.	___	___	X	X	X	___	___	___
b. Inspection and access doors are operable and sealed.	___	___	X	___	X	___	___	___
c. Casing undamaged.	___	___	X	X	X	___	___	___
d. Insulation undamaged.	___	___	X	X	X	___	___	___
e. Condensate drainage is unobstructed. (Visually verify pan drains completely by pouring a cup of water into drain pan.)	___	___	X	X	X	___	___	___
f. Fan belt adjusted.	___	___	X	___	X	___	___	___
g. Manufacturer's required maintenance clearance provided.	___	___	X	X	X	___	___	___
Electrical								
a. Power available to unit disconnect.	___	___	___	X	___	___	___	___
b. Power available to unit control panel.	___	___	___	X	___	___	___	___
c. Proper motor rotation verified.	___	___	___	___	X	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
Coils								
a. Chilled water piping properly connected.	___	___	X	X	X	___	___	___
b. Chilled water piping pressure tested.	___	___	X	X	X	___	___	___
c. Hot water piping properly connected.	___	___	X	X	X	___	___	___
d. Hot water piping pressure tested.	___	___	X	X	X	___	___	___
e. Air vents installed on water coils with shutoff valves as specified.	___	___	X	X	X	___	___	___

f. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___
Controls								
a. Control valves/actuators properly installed.	___	___	X	___	___	___	___	___
b. Control valves/actuators operable.	___	___	X	___	___	___	___	___
c. O.A. dampers/actuators properly installed.	___	___	X	___	___	___	___	___
d. O.A. dampers/actuators operable.	___	___	X	___	___	___	___	___
e. Zone dampers/actuators properly installed.	___	___	X	___	___	___	___	___
f. Zone dampers/actuators operable.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. Construction filters removed and replaced.	___	___	X	___	X	___	___	___
b. TAB report submitted.	___	___	X	___	X	___	___	___
c. TAB results within +10%/-0% of L/s shown on drawings								
d. TAB results for outside air intake within +10%/-0% of L/s shown on drawings.	___	___	X	___	X	___	___	___

SAFETY PAYS

Pre-commissioning Checklist - Pumps

For Each Pump:

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Pumps grouted in place.	___	___	X	X	X	___	___	___
b. Pump vibration isolation devices functional.	___	___	X	X	X	___	___	___
c. Pump/motor coupling alignment verified.	___	___	X	X	X	___	___	___
d. Piping system installed.	___	___	X	X	X	___	___	___
e. Piping system pressure tested.	___	___	X	X	X	___	___	___
f. Pump not leaking.	___	___	X	X	X	___	___	___
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.	___	___	X	X	X	___	___	___
Electrical								
a. Power available to pump disconnect.	___	___	___	X	X	___	___	___
b. Pump rotation verified.	___	___	___	X	X	___	___	___
c. Control system interlocks functional.	___	___	___	X	___	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. Pressure/temperature gauges installed.	___	___	X	___	X	___	___	___
b. Piping system cleaned.	___	___	X	X	X	___	___	___
c. Chemical water treatment complete.	___	___	X	X	X	___	___	___
d. Water balance complete.	___	___	X	___	X	___	___	___
e. Water balance with design maximum flow.	___	___	X	___	X	___	___	___
f. TAB Report submitted.	___	___	X	___	X	___	___	___

SAFETY PAYS

Pre-commissioning Checklist - Packaged Air Cooled Chiller

For Each Packaged Air Cooled Chiller:

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Chiller properly piped.	___	___	X	___	___	___	___	___
b. Chilled water pipe leak tested.	___	___	X	X	X	___	___	___
c. Verify that refrigerant used complies with specified requirements.	___	___	X	X	X	___	___	___
d. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___
e. Manufacturer's required maintenance clearance provided.	___	___	X	X	X	___	___	___
Electrical								
a. Power available to unit disconnect.	___	___	___	X	___	___	___	___
b. Power available to unit control panel.	___	___	___	X	___	___	___	___
c. Separate power is supplied to electric heating tape.	___	___	___	X	___	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
Controls								
a. Factory startup and checkout complete.	___	___	X	X	___	___	___	___
b. Chiller safety/protection devices tested.	___	___	X	X	___	___	___	___
c. Chilled water flow switch installed.	___	___	X	X	___	___	___	___
d. Chilled water flow switch tested.	___	___	X	X	___	___	___	___
e. Chilled water pump interlock installed.	___	___	X	X	X	___	___	___
f. Chilled water pump interlock tested.	___	___	___	X	___	___	___	___

SAFETY PAYS

Pre-commissioning Checklist - Hot Water Boiler

For Each Boiler:

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Boiler flue installed.	___	___	X	___	___	___	___	___
b. Boiler hot water piping installed.	___	___	X	___	___	___	___	___
c. Boiler hot water piping tested.	___	___	X	X	___	___	___	___
d. Boiler makeup water piping installed.	___	___	X	___	___	___	___	___
e. Boiler gas piping installed.	___	___	X	X	X	___	___	___
f. Boiler gas piping tested.	___	___	X	X	X	___	___	___
g. Manufacturer's required maintenance clearance provided.	___	___	X	___	___	___	___	___
Startup								
a. Boiler system cleaned and filled with treated water.	___	___	X	___	___	___	___	___
b. Boiler safety/protection devices, including high temperature burner shut-off, low water cutoff, flame failure, pre and post purge, have been tested.	___	___	___	X	___	___	___	___
c. Verify that PRV rating conforms to boiler rating.	___	___	___	X	___	___	___	___
d. Boiler water treatment system functional.	___	___	X	X	___	___	___	___
e. Boiler startup and checkout complete.	___	___	X	X	___	___	___	___
f. Combustion efficiency demonstrated.	___	___	X	___	X	___	___	___
Electrical								
a. Verify that power disconnect is located within sight of the unit served.	___	___	___	X	___	___	___	___
Controls								
a. Hot water pump interlock installed.	___	___	___	X	___	___	___	___
b. Hot water pump interlock tested.	___	___	___	X	___	___	___	___
c. Hot water heating system balanced.	___	___	X	X	___	___	___	___

d. Hot water heating controls operational. ___ ___ X X ___ ___ ___ ___

SAFETY PAYS

Pre-commissioning Checklist - Fan Coil Unit

For Each Fan Coil Unit:

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Vibration isolation devices installed.	___	___	X	X	X	___	___	___
b. Access doors/removable panels are operable and sealed.	___	___	X	___	X	___	___	___
c. Casing undamaged.	___	___	X	X	X	___	____	___
d. Insulation undamaged.	___	___	X	X	X	___	___	___
e. Condensate drainage is unobstructed.	___	___	X	X	X	___	___	___
f. Fan belt adjusted.	___	___	X	___	X	___	___	___
g. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___
h. Manufacturer's required maintenance clearance provided.	___	___	X	X	X	___	___	___
Electrical								
a. Power available to unit disconnect.	___	___	___	X	___	___	___	___
b. Power available to unit control panel.	___	___	___	X	___	___	___	___
c. Proper motor rotation verified.	___	___	___	___	X	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
Coils								
a. Dual temperature piping properly connected.	___	___	X	___	___	___	___	___
b. Dual temperature piping pressure tested.	___	___	X	___	___	___	___	___
Controls								
a. Verify proper location and installation of thermostat.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. Construction filters removed and replaced.	___	___	X	___	___	___	___	___
b. TAB results +10%/-0% of L/s shown on drawings								

SAFETY PAYS

c. TAB Report submitted. ___ ___ X ___ X ___ ___ ___

SAFETY PAYS

Pre-commissioning Checklist - Unit Heater

For Each Unit Heater:

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Hot water piping properly connected.	___	___	X	___	___	___	___	___
b. Hot water piping pressure tested.	___	___	X	___	___	___	___	___
c. Air vent installed on hot water coil with shutoff valve as specified.	___	___	X	X	X	___	___	___
d. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___
e. Manufacturer's required maintenance/ operational clearance provided.	___	___	X	X	X	___	___	___
Electrical								
a. Power available to unit disconnect.	___	___	___	X	___	___	___	___
b. Proper motor rotation verified.	___	___	___	X	X	___	___	___
c. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
d. Power available to electric heating coil.	___	___	___	X	___	___	___	___
Controls								
a. Control valves properly installed.	___	___	X	___	___	___	___	___
b. Control valves operable.	___	___	X	X	___	___	___	___
c. Verify proper location and installation of thermostat.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. TAB Report submitted.	___	___	X	___	X	___	___	___

SAFETY PAYS

Pre-commissioning Checklist - Exhaust Fan

For Each Exhaust Fan:

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Fan belt adjusted.	___	___	X	___	X	___	___	___
Electrical								
a. Power available to fan disconnect.	___	___	___	X	___	___	___	___
b. Proper motor rotation verified.	___	___	___	___	X	___	___	___
c. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
Controls								
a. Control interlocks properly installed.	___	___	___	X	___	___	___	___
b. Control interlocks operable.	___	___	___	X	___	___	___	___
c. Dampers/actuators properly installed.	___	___	X	___	___	___	___	___
d. Dampers/actuators operable.	___	___	X	___	___	___	___	___
e. Verify proper location and installation of thermostat.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. TAB results +10%/-0% to L/s shown on drawings	___	___	X	___	X	___	___	___
b. TAB Report submitted.	___	___	X	___	X	___	___	___

SAFETY PAYS

Pre-commissioning Checklist - HVAC System Controls

For Each HVAC System:

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. As-built shop drawings submitted.	___	___	X	X	___	___	___	___
b. Layout of control panel matches drawings.	___	___	X	X	___	___	___	___
c. Framed instructions mounted in or near control panel.	___	___	X	X	___	___	___	___
d. Components properly labeled (on inside and outside of panel).	___	___	X	X	___	___	___	___
e. Control components wired to each labeled terminal strip.	___	___	X	X	___	___	___	___
f. EMCS connection made to each labeled terminal strip as shown.	___	___	X	X	___	___	___	___
g. Control wiring and tubing labeled at all terminations, splices, and junctions.	___	___	X	X	___	___	___	___
h. Shielded wiring used on electronic sensors.	___	___	X	X	___	___	___	___
Main Power								
a. 110 volt AC power available to panel.	___	___	___	X	___	___	___	___
Testing, Commissioning, and Balancing								
a. Testing, Commissioning, and Balancing Report submitted.	___	___	X	___	___	___	___	___

SAFETY PAYS

Pre-commissioning Checklist - Single Zone Air Handling Unit

For Each Single Zone Air Handling Unit:

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Vibration isolation devices installed.	___	___	X	X	X	___	___	___
b. Inspection and access doors are operable and sealed.	___	___	X	___	X	___	___	___
c. Casing undamaged.	___	___	X	X	X	___	___	___
d. Insulation undamaged.	___	___	X	X	X	___	___	___
e. Condensate drainage is unobstructed.	___	___	X	X	X	___	___	___
f. Fan belt adjusted.	___	___	X	___	X	___	___	___
g. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___
h. Manufacturer's required maintenance clearance provided.	___	___	X	X	X	___	___	___
Electrical								
a. Power available to unit disconnect.	___	___	___	X	X	___	___	___
b. Power available to unit control panel.	___	___	___	X	___	___	___	___
c. Proper motor rotation verified.	___	___	___	___	X	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
e. Power available to electric heating coil.	___	___	___	X	___	___	___	___
Coils								
a. Chilled water piping properly connected.	___	___	X	___	___	___	___	___
b. Chilled water piping pressure tested.	___	___	X	X	X	___	___	___
c. Hot water piping properly connected.	___	___	X	___	___	___	___	___
d. Hot water piping pressure tested.	___	___	X	X	___	___	___	___
g. Air vents installed on water coils with shutoff valves as specified.	___	___	X	X	X	___	___	___
h. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___
Controls								

SAFETY PAYS

a. Control valves/actuators properly installed.	___	___	X	___	___	___	___	___
b. Control valves/actuators operable.	___	___	X	___	___	___	___	___
c. Dampers/actuators properly installed.	___	___	X	___	___	___	___	___
d. Dampers/actuators operable.	___	___	X	___	___	___	___	___
e. Verify proper location and installation of thermostat.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. Construction filters removed and replaced.	___	___	X	___	X	___	___	___
b. TAB results +10%/-0% L/s shown on drawings.	___	___	X	___	X	___	___	___
c. TAB Report submitted.	___	___	X	___	X	___	___	___

SAFETY PAYS

APPENDIX B

FUNCTIONAL PERFORMANCE TESTS CHECKLISTS

SAFETY PAYS

Functional Performance Test Checklist - Pumps

For Each Pump:

Prior to performing this checklist, ensure that for closed loop systems, system is pressurized and the make-up water system is operational or, for open loop systems, that the sumps are filled to the proper level.

1. Activate pump start using control system commands (all possible combination, on/auto, etc.). ON_____ AUTO_____ OFF_____

a. Verify pressure drop across strainer:

Strainer inlet pressure _____ kPa (_____ psig)
Strainer outlet pressure _____ kPa (_____ psig)

b. Verify pump inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report, pump design conditions, and pump manufacturer's performance.

	DESIGN	TAB	ACTUAL
Pump inlet pressure (kPa guage)	_____	_____	_____
Pump outlet pressure (kPa gauge)	_____	_____	_____

c. Operate pump at shutoff and at 100 percent of designed flow when all components are in full flow. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (kPa guage)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (L/s)	_____	_____

d. Operate pump at shutoff and at minimum flow or when all components are in full by-pass. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (kPa guage)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (L/s)	_____	_____

2. Verify motor amperage each phase and voltage phase to phase and phase to ground for both the full flow and the minimum flow conditions.

a. Full flow:

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage		_____	_____
Voltage		_____	
Voltage to ground	_____	_____	_____

b. Minimum flow:

SAFETY PAYS

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage		_____	_____
Voltage		_____	
Voltage to ground	_____	_____	_____

3. Unusual vibration, noise, etc.

_____

_____

4. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative_____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Design Agency’s Representative _____

SAFETY PAYS

Functional Performance Test Checklist - Single Zone Air Handling Unit

For Each Single Zone Air Handling Unit:

1. Functional Performance Test: Contractor shall verify operation of air handling unit as per specification including the following:

a. The following shall be verified when the supply fan operating mode is initiated:

(1) All dampers in normal position. _____

(2) All valves in normal position. _____

(3) System safeties allow start if safety conditions are met. _____

b. Occupied mode of operation - economizer de-energized.

(1) Outside air damper at minimum position. _____

(2) Return air damper open. _____

(3) Relief air damper closed. _____

(4) Chilled water control valve modulating to maintain space cooling temperature set point. _____

(5) Hot water control valve modulating to maintain space heating temperature set point input from outside air temperature controller. _____

c. Occupied mode of operation - economizer energized.

(1) Outside air damper modulated to maintain mixed air temperature set point. _____

(2) Relief air damper modulates with outside air damper according to sequence of operation. _____

(3) Chilled water control valve modulating to maintain space cooling temperature set point. _____

d. Unoccupied mode of operation

(1) All dampers in normal position. _____

(2) Verify low limit space temperature is maintained as specified in sequence of operation. _____

e. The following shall be verified when the supply fan off mode is initiated:

(1) All dampers in normal position. _____

(2) All valves in normal position. _____

(3) Fan de-energizes. _____

f. Verify cooling coil and heating coil operation by varying thermostat set point from cooling set point to heating set point and returning to cooling set point. _____

g. Verify safety shut down initiated by smoke detectors. _____

h. Verify safety shut down initiated by low temperature protection thermostat. _____

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative_____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Design Agency’s Representative _____

SAFETY PAYS

Functional Performance Test Checklist - Bypass Multizone Air Handling Unit

For Each Bypass Multizone Air Handling Unit:

Ensure that a slight negative pressure exists on inboard side of the outside air dampers throughout the operation of the dampers. Modulate OA, RA, and EA dampers from fully open to fully closed positions.

1. Functional Performance Test: Contractor shall verify operation of air handling unit as per specification including the following:

a. The following shall be verified when the supply and relief fans operating mode is initiated:

(1) All dampers in normal position. _____

(2) All valves in normal position. _____

(3) System safeties allow start if safety conditions are met. _____

b. Occupied mode of operation - economizer de-energized, ventilation energized.

(1) Outside air damper at minimum position. _____

(2) Return air damper open. _____

(3) Relief <u>or exhaust</u> air damper <u>open</u>. _____

(4) Chilled water control valve modulating to maintain cold deck supply air temperature setpoint._____

(5) Hot water control valve modulating to maintain hot deck supply air temperature set point input from outside air temperature controller. _____

c. Occupied mode of operation - economizer energized.

(1) Outside air damper modulates to maintain mixed air temperature set point. _____

(2) Relief air damper modulates with outside air damper according to sequence of operation. _____

(3) Chilled water control valve modulating to maintain cold deck supply air temperature set point. _____

(4) Hot water <u>zone</u> control valve modulating to maintain hot deck supply air temperature set point input from outside air temperature controller._____

d. Unoccupied mode of operation

(1) All dampers in normal position. _____

(2) Verify low limit space temperature is maintained as specified

in sequence of operation. _____

e. The following shall be verified when the supply and return fans off mode is initiated:

(1) All dampers in normal position. _____

(2) All valves in normal position. _____

(3) Fan de-energizes. _____

f. Verify zone damper operation by varying zone thermostat set points from cooling set point to heating set point and returning to cooling set point. _____

g. Verify safety shut down initiated by smoke detectors. _____

h. Verify safety shut down initiated by low temperature protection thermostat. _____

i. Index room thermostats to full cooling then to full heating. Measure and record cold deck, hot deck, and supply air temperatures and determine damper leakage for a minimum of 2 zones.

Cold deck temperature _____ degrees C (_____ degrees F)
Bypass deck temperature _____ degrees C (_____degrees F)

Zone 1
Cooling temperature _____ degrees C (_____ degrees F)
Heating temperature _____ degrees C (_____ degrees F)
Damper leakage cooling _____ degrees C (_____ degrees F)
Damper leakage bypass _____ degrees C (_____ degrees F)

Zone 2
Cooling temperature _____ degrees C (_____ degrees F)
Heating temperature _____ degrees C (_____ degrees F)
Damper leakage cooling _____ degrees C (_____ degrees F)
Damper leakage heating _____ degrees C (_____degrees F)

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative_____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative
_____

Contractor's Controls Representative _____

SAFETY PAYS

Contracting Officer's Representative _____

Using Agency's Representative _____

Design Agency’s Representative _____

SAFETY PAYS

Functional Performance Test Checklist - Packaged Air Cooled Chiller

For Each Packaged Air Cooled Chiller:

1. Functional Performance Test: Contractor shall demonstrate operation of chilled water system as per specifications including the following: Start building air handler to provide load for chiller. Activate controls system chiller start sequence as follows.

a. Start chilled water pump and establish chilled water flow. Verify chiller-chilled water proof-of-flow switch operation. _____

b. Verify control system energizes chiller start sequence. _____

c. Verify chiller senses chilled water temperature above set point and control system activates chiller start. _____

d. Verify functioning of "soft start" sequence. _____

e. Shut off air handling equipment to remove load on chilled water system. Verify chiller shutdown sequence is initiated and accomplished after load is removed. _____

f. Restart air handling equipment one minute after chiller shut down. Verify chiller restart sequence. _____

2. Verify chiller inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report, chiller design conditions, and chiller manufacturer's performance data.

	DESIGN	TAB	ACTUAL
Chiller inlet pressure (kPa guage)	_____	_____	_____
Chiller outlet pressure (kPa gauge)	_____	_____	_____

3. Verify chiller amperage each phase and voltage phase-to-phase and phase-to-ground.

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	
Voltage	_____		
Voltage to ground	_____	_____	_____

4. Record the following information:

Ambient dry bulb temperature _____ degrees C
Ambient wet bulb temperature _____ degrees C
Entering chilled water temperature _____degrees C
Leaving chilled water temperature _____ degrees C

5. Unusual vibration, noise, etc.

_____

_____

SAFETY PAYS

6. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative_____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative
_____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Design Agency’s Representative _____

SAFETY PAYS

Functional Performance Test Checklist - Hot Water Boiler

For Each Boiler:

1. Functional Performance Test: Contractor shall demonstrate operation of hot water system as per specifications including the following: Start building heating equipment to provide load for boiler. Activate controls system boiler start sequence as follows.

a. Start hot water pump and establish hot water flow. Verify boiler hot water proof-of-flow switch operation. _____

b. Verify control system energizes boiler start sequence. _____

c. Verify boiler senses hot water temperature below set point and control system activates boiler start. _____

d. Shut off building heating equipment to remove load on hot water system. Verify boiler shutdown sequence is initiated and accomplished after load is removed. _____

2. Verify boiler inlet/outlet pressure reading, compare to Test and Balance (TAB) Report, boiler design conditions, and boiler manufacturer's performance data.

	DESIGN	TAB	ACTUAL
Boiler inlet pressure (kPa gauge)	_____	_____	_____
Boiler outlet pressure (kPa gauge)	_____	_____	_____
Boiler flow rate (L/s)	_____	_____	_____
Flue-gas temperature at boiler outlet		_____	_____
Percent carbon dioxide in flue-gas		_____	_____
Draft at boiler flue-gas exit		_____	_____
Draft or pressure in furnace		_____	_____
Stack emission pollutants concentration	_____	_____	_____
Fuel type	_____	_____	_____
Combustion efficiency	_____	_____	_____

3. Record the following information:

Ambient temperature _____ degrees C
Entering hot water temperature _____ degrees C
Leaving hot water temperature _____ degrees C

4. Verify temperatures in item 3 are in accordance with the reset schedule. _____

5. Verify proper operation of boiler safeties. _____

6. Unusual vibration, noise, etc.

_____

_____

7. Visually check refractory for cracks or spalling and refractory and

tubes for flame impingement. _____

8. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Chief Quality Control Representative	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting and Balancing Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____
Using Agency's Representative	_____
Design Agency’s Representative	_____

SAFETY PAYS

Functional Performance Test Checklist - Fan Coil Units

The Contracting Officer will select fan coil units to be spot-checked during the functional performance test. The number of terminals shall not exceed 10 percent.

1. Functional Performance Test: Contractor shall demonstrate operation of selected fan coils as per specifications including the following:

a. Cooling/heating fan coils:

(1) Verify fan coil unit response to room temperature set point adjustment. Changes to be cooling set point to heating set point and return to cooling set point. _____

(2) Check blower fan air flow. _____ L/s
Check blower fan air flow.

(3) Check coil water flow. _____ L/s
Check coil water flow.

(4) Check cooling mode inlet air temperature. _____ degrees C
Check cooling mode inlet air temperature.

(5) Check cooling mode outlet air temperature. _____ degrees C
Check cooling mode outlet air temperature.

(6) Check heating mode inlet air temperature. _____ degrees C
Check heating mode inlet air temperature.

(7) Check heating mode outlet air temperature. _____ degrees C
Check heating mode outlet air temperature.

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative_____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative
_____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Design Agency’s Representative _____

SAFETY PAYS

Functional Performance Test Checklist - Unit Heaters

The Contracting Officer will select unit heaters to be spot-checked during the functional performance test. The number of terminals shall not exceed 10 .

1. Functional Performance Test: Contractor shall demonstrate operation of selected unit heaters as per specifications including the following:

a. Verify unit heater response to room temperature set point adjustment. Changes to be heating set point to heating set point minus 10 degrees and return to heating set point. _____

b. Check blower fan speed. _____rpm

c. Check heating mode inlet air temperature. _____ degrees C
Check heating mode inlet air temperature.

d. Check heating mode outlet air temperature. _____ degrees C
Check heating mode outlet air temperature.

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative_____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative
_____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Design Agency’s Representative _____

Functional Performance Test Checklist - HVAC Controls

For Each HVAC System:

The Contracting Officer will select HVAC control systems to undergo functional performance testing. The number of systems shall not exceed 2 .

1. Functional Performance Test: Contractor shall verify operation of HVAC

controls by performing the following tests:

a. Verify that controller is maintaining the set point by manually measuring the controlled variable with a thermometer, sling psychrometer, inclined manometer, etc.

b. Verify sensor/controller combination by manually measuring the controlled medium. Take readings from control panel display and compare readings taken manually. Record all readings.

Sensor _____
Manual measurement _____
Panel reading value _____

c. Verify system stability by changing the controller set point as follows:

(1) Air temperature - 10 degrees F

(2) Water temperature - 10 degrees F

The control system shall be observed for 10 minutes after the change in set point. Instability or excessive hunting will be unacceptable.

d. Verify interlock with other HVAC controls.

e. Verify interlock with fire alarm control panel.

f. Verify interlock with EMCS.

2. Verify that operation of control system conforms to that specified in the sequence of operation.

3. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Chief Quality Control Representative	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting and Balancing Representative	_____
Contractor's Controls Representative	_____
Contractor's Officer's Representative	_____
Using Agency's Representative	_____
Design Agency’s Representative	_____

--END OF SECTION--

SECTION 15995

COMMISSIONING OF HVAC SYSTEMS

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SUBMITTAL REGISTER (ER415-1-10)	CONTRACT NO.
TITLE AND LOCATION Discom Barracks Complex, Phase I Ft. Campbell, Kentucky	CONTRACTOR
	SPEC. SECTION 15995

ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.1 SUBMITTALS										
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			SD-06 Instructions										
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			SD-07 Schedules										
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***** SAFETY PAYS *****

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SECTION 16311

MAIN ELECTRIC SUPPLY STATION AND SUBSTATION
11/92

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(1995) Code for Electricity Metering
ANSI C12.4	(1984; R 1996) Mechanical Demand Registers
ANSI C12.10	(1987) Electromechanical Watthour Meters
ANSI C12.11	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
ANSI C29.1	(1988; R 1996) Electrical Power Insulators - Test Methods
ANSI C29.2	(1992) Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type
ANSI C29.9	(1983; R 1996) Wet-Process Porcelain Insulators - Apparatus, Post-Type
ANSI C37.06	(1987; C37.06a; R 1994) AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities for Switchgear
ANSI C37.16	(1988; C37.16a; R 1995) Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
ANSI C37.32	(1996) High-Voltage Air Switches, Bus Supports, and Switch Accessories - Schedules of Preferred Ratings, Manufacturing Specifications, and Application Guide
ANSI C37.46	(1981; R 1992) Power Fuses and Fuse Disconnecting Switches
ANSI C37.121	(1989; R 1995) Switchgear, Unit Substations Requirement
ANSI C39.1	(1981; R 1992) Requirements for Electrical Analog Indicating Instruments

ANSI C57.12.10	(1987) Safety Requirements for Transformers 230 kV and Below 833/958 Through 8333/10417 kVA, Single-Phase, and 750/862 Through 60 000/80 000/100 000 kVA, Three-Phase Without Load Tap Charging; and 3750/4687 Through 60 000/80 000/100 000 kVA With Load Tap Charging
ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1996) Carbon Structural Steel
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153	(1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 572/A 572M	(1994c) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 575	(1989) Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A 576	(1990b; R 1995) Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM A 633/A 633M	(1995) Normalized High-Strength Low-Alloy Structural Steel Plates
ASTM B 8	(1995) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 117	(1995) Operating Salt Spray (Fog) Apparatus
ASTM B 188	(1996) Seamless Copper Bus Pipe and Tube
ASTM B 231	(1995) Concentric-Lay-Stranded Aluminum 1350 Conductors
ASTM B 317	(1996) Aluminum-Alloy Extruded Bar, Rod, Tube, Pipe, and Structural Profiles for Electrical Purposes (Bus Conductor)
ASTM D 923	(1991) Sampling Electrical Insulating Liquids
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2472	(1992) Sulfur Hexafluoride
ASTM D 4059	(1991) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography

ASTM F 883	(1990) Padlocks

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B31.3	(1996; B31.1a) Chemical Plant and Petroleum Refinery Piping
ASME BPV IX	(1995; Addenda Dec 1995, Dec 1996) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1996) Structural Welding Code - Steel

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
IEEE ANSI/IEEE C37.1	(1994) IEEE Standard Definition, Specification, and Analysis of Systems Used for Supervisory Control, Data Acquisition, and Automatic Control
IEEE ANSI/IEEE C37.2	(1991) Electrical Power System Device Function Numbers
IEEE ANSI/IEEE C37.04	(1979; R 1988, C37.04g; C37.04i) Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
IEEE ANSI/IEEE C37.09	(1979; R 1988; C37.09a; C37.09c, C37.09e; C37.09g) Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
IEEE ANSI/IEEE C37.081	(1981; R 1988) Guide for Synthetic Fault Testing of AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
IEEE ANSI/IEEE C37.13	(1990; R 1995) Low-Voltage AC Power Circuit Breakers Used in Enclosures
IEEE ANSI/IEEE C37.20.2	(1993; C37.20.2b) Metal-Clad and Station-Type Cubicle Switchgear
IEEE ANSI/IEEE C37.23	(1987; R 1991) Guide for Metal-Enclosed Bus and Calculating Losses in Isolated-Phase Bus
IEEE ANSI/IEEE C37.30	(1992) Definitions and Requirements for High-Voltage Air Switches
IEEE ANSI/IEEE C37.34	(1994) Test Code for High-Voltage Air Switches
IEEE ANSI/IEEE C37.41	(1994) Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories

IEEE ANSI/IEEE C37.90	(1989) Relays and Relay Systems Associated with Electric Power Apparatus
IEEE ANSI/IEEE C37.90.1	(1989; R 1994) IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems
IEEE ANSI/IEEE C37.98	(1987; R 1991) Seismic Testing of Relays
IEEE ANSI/IEEE C57.12.00	(1993) IEEE Standard General Requirements for Liquid -Immersed Distribution, Power, and Regulating Transformers
IEEE ANSI/IEEE C57.12.01	(1989) Dry-Type Distribution and Power Transformers Including Those With Solid Cast and/or Resin - Encapsulated Windings
IEEE ANSI/IEEE C57.12.80	(1978; R 1992) Terminology for Power and Distribution Transformers
IEEE ANSI/IEEE C57.12.90	(1993) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers
IEEE ANSI/IEEE C57.13	(1993) Instrument Transformers
IEEE ANSI/IEEE C57.15	(1986; R 1992) Requirements, Terminology, and Test Code for Step-Voltage and Induction-Voltage Regulators
IEEE ANSI/IEEE C57.19.00	(1991) IEEE Standard General Requirements and Test Procedures for Outdoor Power Apparatus Bushings
IEEE ANSI/IEEE C57.19.01	(1991) Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings
IEEE ANSI/IEEE C57.93	(1995) Guide for Installation of Liquid Immersed Power Transformers
IEEE ANSI/IEEE C57.98	(1993) Guide for Transformer Impulse Tests
IEEE C62.1	(1989; R 1994) Surge Arresters for AC Power Circuits
IEEE C62.2	(1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems
IEEE C62.11	(1993) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits
IEEE Std 32	(1972; R 1990) Requirements, Terminology, and Test Procedure for Neutral Grounding Devices
IEEE Std 80	(1986; R 1991) IEEE Guide for Safety in AC Substation Grounding

IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 100	(1996) IEEE Standard Dictionary of Electrical and Electronics Terms
IEEE Std 242	(1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE Std 399	(1990) Recommended Practice for Industrial and Commercial Power Systems Analysis
IEEE Std 484	(1996) Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications
IEEE Std 485	(1983) Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations
IEEE Std 525	(1992) IEEE Guide for the Design and Installation of Cable Systems in Substations

ISA INTERNATIONAL (ISA)

ISA ANSI/ISA S18.1	(1979; R 1992) Annunciator Sequences and Specifications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches
NEMA LA 1	(1992) Surge Arresters
NEMA PB 1	(1990) Panelboards
NEMA SG 2	(1993) High Voltage Fuses
NEMA SG 3	(1995) Power Switching Equipment
NEMA SG 5	(1990) Power Switchgear Assemblies
NEMA SG 6	(1995) Power Switching Equipment
NEMA WD 1	(1983; R 1989) General Requirements for Wiring Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996; Errata) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6	(1997) Rigid Metal Conduit
UL 50	(1995; Rev thru Aug 1997) Enclosures for Electrical Equipment
UL 67	(1993; Rev thru Dec 1993) Panelboards
UL 467	(1993; Rev thru Aug 1996) Grounding and Bonding Equipment
UL 486B	(1997; Rev Jun 1997) Wire Connectors for Use with Aluminum Conductors
UL 489	(1996; Rev May 1997) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 1236	(1994; Rev thru Apr 1996) Battery Chargers for Charging Engine-Starter Batteries

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

1.2.2 System Description

The system shall be configured as specified, and shall include structures, incoming and outgoing lines, transformers, regulators, fuses, circuit breakers, switches, switchgear, and appurtenances to provide a fully functional system.

1.2.3 Service Conditions

Items provided under this section shall be specifically suitable for the following service conditions.

a. Altitude 170 m

b. Ambient Temperature 33.3 degrees C

c. Frequency 60 Hz

d. Seismic Zone 2

1.2.4 Incoming and Outgoing Circuit Compliance

Underground circuits shall comply with the requirements of Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Fault Current and Protective Devices Coordination Studies; GA.

The study shall be submitted along with protective device equipment submittals. No time extensions or similar contract modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed shall be based on recommendations of this study. The Government shall not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

Manufacturer's Catalog; GA.

Submit data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists; GA.

A complete itemized listing of equipment and materials proposed for incorporation into the work shall be submitted. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each such item.

Installation Procedures; FIO.

As a minimum, the Contractor shall submit installation procedures for station buses and insulators, grounding, switches and all other related components. Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

SD-04 Drawings

Electrical Supply Station; GA.

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams, and other information necessary to define the installation shall be submitted. Detail drawings shall show the ratings of items and systems and how the components of an item and system are assembled, function together, and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall show physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Detail drawings shall include:

a. Incoming Line and Station buss structures and integral equipment.

b. Station single line electrical diagrams including primary, metering, sensing and relaying, control wiring, and control logic.

Structural drawings shall be prepared to show the structural or physical features of major items of station equipment and components of equipment or equipment assemblies and structures, including foundations or other types of supports for equipment and conductors. Those drawings shall include accurately scaled or dimensioned outline and arrangement or layout drawings to show the physical size of station equipment and component parts of the equipment and the relative arrangement of components and any physical connection of related components. Weights of equipment and components of equipment assemblies shall be provided when required to verify the adequacy of design and proposed construction of foundations or other types of supports. Dynamic forces shall be stated for switching devices when such forces must be considered in the design of support structures. The appropriate detail drawings shall show the provisions for leveling, anchoring, and connecting all items of station equipment during installation, and shall include any recommendations made by the manufacturer of the equipment.

Electrical drawings shall include single-line and three-line diagrams of the station and station equipment, schematics or elementary diagrams of each electrical system; internal wiring and external connection diagrams of each electrical device when published by the manufacturer; wiring diagrams of cabinets, panels, units, or other separate mountings; interconnection diagrams that show the wiring between separate components of assemblies; external connection diagrams that show the termination of wiring routed between separate items of station equipment; internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures, including changes in related portions of the project and the reasons therefore, shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Government.

As-Built Drawings; FIO.

The as-built drawings shall be a record of the construction as installed. The drawings shall include all the information shown on the contract drawings as well as all deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full sized set of prints marked to reflect all deviations, modifications, and changes. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

SD-08 Statements

On-Site Test; GA.

A detailed description of the Contractor's proposed procedures for on-site tests.

SD-09 Reports

Factory Test Reports; GA.

Six copies of the information described below in 215.9 x 279.4 mm (8 1/2 x 11 inch)binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of all equipment used, with calibration certifications.

b. A copy of all measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The condition specified for the test.

f. The test results, signed and dated.

g. A description of all adjustments made.

Field Test Plan; GA.

A detailed description of the Contractor's proposed procedures for on-site tests submitted 20 days prior to testing the installed system. No field test will be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Field Test Reports; GA.

Six copies of the information described below in 215.9 x 279.4 mm (8 1/2 x 11 inch)binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of all equipment used, with calibration certifications.

b. A copy of all measurements taken.

c. The dates of testing.

d. The equipment and values verified.

e. The condition specified for the test.

f. The test results, signed and dated.

g. A description of all adjustments made.

h. Final position of controls, and device settings.

SD-13 Certificates

Materials and Equipment; GA.

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories, Inc., (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the

National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided under this section of the specifications conform to such requirements. The label of, or listing by, UL will be acceptable evidence that the items conform thereto. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable evidence that the item conforms thereto. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable evidence that the item conforms thereto. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

SD-19 OPERATION AND MAINTENANCE MANUALS

Electric Supply Station; FIO.

Six copies of operation and maintenance manuals, within 7 calendar days following the completion of tests and including assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare-parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

Three additional copies of the instructions manual within 30 days following the approval of the manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements.

1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the Contracting Officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

Products shall conform to the following requirements. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

2.2.1 General

Each major component of this specification shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of non-corrosive metal. As a minimum, nameplates shall be provided for circuit breakers

2.2.2 NOT USED

2.3 CORROSION PROTECTION

2.3.1 Aluminum Materials

Aluminum shall not be used in contact with earth or concrete. Where aluminum conductors are connected to dissimilar metal, fittings conforming to UL 486B shall be used.

2.3.2 Ferrous Metal Materials

2.3.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153 and ASTM A 123.

2.3.2.2 Equipment

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaires not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1.6 mm (1/16 inch)from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.3.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in Section 09900 PAINTING, GENERAL.

2.4 Station Arrangement

2.4.1 Conductors

Conductors shall be aluminum-conductor-steel-reinforced (ACSR) with sizes as indicated, and shall comply with IEEE Std 525. Span lengths shall be based on a limiting deflection of 1/150 for spans having two supports and 1/200 for spans having three supports, under maximum wind, ice, and short-circuit loadings, including suitable allowances for any taps. Where required, larger or stronger bus shall be installed to maintain specified deflections for the indicated span lengths. Other bus shapes for electrical conductors may be used if detail drawing submittals indicate equivalent ampacity and

strength. Short connections, consisting of bare stranded conductors of equivalent bus ampacity, may be used between incoming line conductors and buses or between buses and equipment. Copper flexible braid or aluminum strap expansion couplers, as required to match the bus material, shall be installed in bus runs where required to allow for expansion and contraction, and at all connections to transformer bushings.

2.4.2.1 Suspension Insulators

Suspension insulators shall be provided for dead-end incoming line conductors. Suspension insulator strings and string supports shall provide a mechanical strength exceeding the ultimate strength of each dead-end conductor. Minimum ratings of suspension insulators shall be not less than ANSI C29.2 Class 52-4.

2.4.2.2 Apparatus Post Insulators

Apparatus post insulators shall be provided to support conductors, and their mechanical strength shall exceed the ultimate strength of the conductor supported and, where necessary, high-strength or ultra high-strength insulators shall be provided. Minimum ratings of apparatus post insulators shall be not less than ANSI C29.9.

2.5 INCOMING SWITCHING/CIRCUIT INTERRUPTING EQUIPMENT

Incoming line switching equipment shall be of the outdoor weatherproof type. Operating characteristics and ratings of incoming line switching equipment shall be as indicated.

2.5.1 Vaccum Breaker

2.5.1.1 General

This specification applies to an outdoor, three pole, single throw, free standing, dead tank, vacuum circuit breaker.
The circuit breaker will be used on a 15.5 kV, 3 phase, 60 hertz system and be complete from the incoming bushing studs to the outgoing bushing studs including bushing connectors. The breaker shall be designed, manufactured and tested in accordance with ANSI, IEEE, NESC and NEMA specifications.
The breaker shall be manufactured in a facility that is Quality Systems Registered by Underwriters Laboratories, Inc. to ISO 9001.

2.5.1.2 Ratings

The breaker shall meet the following ratings and electrical characteristics:

Required maximum voltage	15.5kV, RMS
Insulation level:	
Low Frequency (Dry, 1 minute)	50kV, RMS
Impulse Crest (Fullwave)	110kV, RMS
Rated Continuous Current	600 Amp, RMS
Rated Short Circuit Current	12 kA,RMS(At rated max kV)
Rated Interrupting Time (max.)	3 cycles
Rated Permissible Tripping Delay, Y	2 seconds
Maximum Symmetrical Interrupting Current	12 kA,RMS(At rated max kV)
3-Second Short Time Current Rating	12 kA,RMS
Close and Latch Rating	32 kA, peak
Duty Cycle	OCO-15 sec-CO
Closing Control Voltage	240 VAC

Tripping Control Voltage	240 V AC
Motor Voltage	240 V AC
Heater Voltage	240 VAC
Bushing Current Transformer(Multi-Ratio)	
CT Ratios	Variable up to 600
Accuracy Class at Full Winding	Varies with CT ratio
Number of CT's on each bushing	2,4,6

The breaker shall be rated for an ambient temperature range of -30 degrees to +40 degrees Celsius. The breaker shall be rated for Seismic Zone 2 as described by ANSI/IEEE 693-1984. The breaker shall be rated to withstand a wind load of 90 mph imposed upon the structure supporting the terminal connection per ANSI C37.04 Section 6.2. The breaker shall be rated for use at altitudes up to 1006 m above sea level per ANSI C37.04 Section 4.2.2. For altitudes over 1006 m, the rated dielectric strength and rated maximum voltage and current shall be multiplied by altitude correction factors to obtain values at which applications may be made.

2.5.1.3 Mechanical Construction

For continuous current ratings of 2000A and below, the enclosure shall be ARC-RESISTANT design, based on EEMAC standards, for personnel and equipment safety. The enclosure shall be weatherproof and designed in a modular construction isolating line potential components from secondary control. The high voltage compartment shall house the vacuum interrupter assemblies supported on porcelain standoff insulators. The enclosure shall be provided with lifting eyes for lifting the entire unit during loading and unloading. The breaker shall be shipped completely assembled. Breakers shall not be shipped with legs unattached. The enclosure shall be painted ANSI #70 light gray with a TGIC polyester powder coat protective paint finish. Total paint thickness on exterior surfaces shall be 1.0-3.0 mils. Production samples shall have passed 4,000 hours minimum of salt spray testing per ASTM B-117 and ASTM D-1654 Procedure A with a rating of 6 or higher. One 6-ounce spray can of touch-up paint to match exterior finish shall be provided.

The breaker legs shall be painted and have an adjustable height range of 600mm in 3 increments. Total height of breaker shall vary from 2.6 m minimum to 3.2 m maximum. Leg assemblies shall have a hot dipped galvanized base channel. Outer doors shall have padlockable handles for preventing access to all controls in the enclosure. Doors are to be gasketless and vertically hinged. Provisions for holding all doors in the open position 180 degrees shall also be provided. It shall be documented that the breaker passed rain testing per ANSI C37.20.2, Section 5.2.9. The low voltage cabinet bottom shall have an 200mm x 360mm removable cover for entrance of users control conduit. Conduit entry location to be clearly marked on detail drawings. All external hardware shall be stainless steel.

2.5.1.4 Grounding

Ground pads, 50mm x 90mm with provisions for NEMA 2-hole connectors, shall be welded on each side of the enclosure for external ground connections. #4 cables from the roof and HV & LV compartments shall be connected internally to the ground pads to insure a solidly grounded enclosure, with negligible difference in ground potential between compartments. Enclosure grounding shall not depend on bolted connections or star washers.

2.5.1.5 Breaker Interrupter

The vacuum interrupters shall be hermetically sealed in high vacuum, protecting contacts from moisture and contaminated atmosphere. The interrupters shall be maintenance free. Circuit breaker shall have readily accessible provisions for measuring the contact wear for each pole. Provisions for slow closing of the contacts are to be provided. The circuit breaker total interrupting time is not to exceed 3 cycles. A minimum of 4 auxiliary contacts (2a,2b) shall be provided for external use.

2.5.1.6 Operating Mechanism

The mechanism shall be device type 52/M spring-charged stored-energy with electrical charging motor. The mechanism and control circuits shall be located in the low voltage compartment. The mechanism shall not be mounted in a separate housing. The mechanism shall be designed with an integral, manual charging handle. Charging handle shall not be removable. The mechanism shall be mechanically and electrically trip free and non-pumping for both manual and automatic operations. The following shall be clearly visible on the mechanism when the outer door is closed:

a. A mechanical 4-digit operation counter which increases on each trip operation

b. A mechanical indicator to indicate the open and closed positions of the circuit breaker.

c. A mechanical indicator to indicate the status of the closing springs.

d. Open and close push-buttons for operating the breaker.

The standard design shall have a 12 contact auxiliary switch, of which 6 with AC control are used for internal breaker wiring. When specified, an additional auxiliary switch with 6 a and 6 b contacts shall be provided for external use. The mechanism shall be designed with a latch-check switch and shall be equipped with a dual trip coil. Spring charging motor shall have 240 VAC dropping resistor.

2.5.1.7 Bushings

Six (6) roof bushings shall be provided. The material shall be porcelain and ANSI # 70 light gray in color. Bushing terminals shall be threaded stud type and capable of accepting either 4-hole NEMA stud to flat connectors (Type HDSF) or stud to cable connectors (Type DS). Connectors shall be sized per cable size shown on the drawers. Bushings shall have a minimum rating of 15kV, 110kV BIL. Minimum bushing creepage distance shall be 24.5.

Five-tap, multi-ratio current transformers shall be supplied for each bushing. Ratio and accuracy are to be determined by the user. All secondary leads shall be terminated on short-circuit type terminal blocks in the low voltage compartment and can be accessible at all times with the breaker energized.

Each bushing shall be capable of equipping either 3 standard accuracy, 2 double accuracy or 1 triple accuracy 1200:5 multi-ratio CT.

2.5.1.8 Controls

Control wire shall be #14 AWG Type SIS for general control and #12 AWG Type SIS for CT circuits. Wire color shall be gray. Terminal blocks for control circuits and users external connections are to be Type EB25 with terminal marking strips labeled in accordance with the wire diagrams. Short circuit terminal blocks are to be Type EB27 with shorting screws and common shorting bar for each individual current transformer.

a. Control circuit shall be provided with fused switches or low voltage circuit breakers for disconnecting external low voltage supply circuits.

b. An anti-pump relay device type 52/Y shall be provided to inhibit multiple close-open operations in the event that a continuous close signal is applied.

c. One pistol grip control switch, Electro-switch Series 24, engraved TRIP-CLOSE shall be supplied.

d. Red and green indicating lamps, Type ET-16 LED, for closed or open status of the breaker shall be supplied.

e. Space heaters, device type H1-H2, rated 240VAC, shall be supplied to prevent moisture condensation in the breaker enclosure. Heaters shall be thermostatically controlled, device type 23, over an ambient temperature range of 0 degrees F to 104 degrees F and located in the low voltage compartment. The heater control circuit shall be provided with device type 8H, AC circuit breaker, 240 VAC, 10A, DPST for disconnecting external low voltage supply circuit. The heater shall be connected to a cabinet door-actuated switch, so the heater is de-energized when the doors are open. High temperature thermal protection shall be included.

f. An emergency manual trip, ANSI Device Number 69, shall be provided and shall be readily accessible on the exterior mechanism side of the breaker. It shall be labeled MANUAL TRIP OPEN and the actuating handle shall be painted red. The device shall be operable from the exterior of the breaker without the necessity of opening any doors, panels, etc. Actuation of the device will block any electrical closing of the breaker until the switch has been manually reset.

g. A device type 52/MR, 240 VAC motor relay shall be supplied.

2.5.1.9 Miscellaneous items to be provided:

a. A device type 52/CC 240 VAC close coil.

b. A device type 52/TC, 125 VD trip coil.

c. A 52A&B, 6 deck auxiliary switch assembly.

d. A device type CTU, capacitor trip unit without light.

2.5.2 Devices and Accessories for Switching/Interrupting Equipment

2.5.2.1 Incoming Line

Incoming line units shall be coordinated with the requirements of the serving utility, and to the protected transformer, and shall include the following control and monitoring system items that shall be mounted in the instrument and relay cabinet specified below.

a. An ammeter and an ammeter switch.

b. A control switch for local or remote control operation.

c. Three overcurrent relays, devices 50/51.

d. One residually-connected ground-overcurrent relay, device 50/51N.

e. Three phase secondary current test blocks with associated test plug for each three-phase set of current transformers.

2.5.3 NOT USED

2.5.4 Line Switches

2.5.4.1 Ratings

Ratings at 60 Hz shall be in accordance with ANSI C37.32 and as follows:

Nominal voltage.....12.470

Rated maximum voltage.....15.5

Maximum symmetrical interrupting capacity.....99 kA

3-Second short time current carrying capacity.....38 kA

Rated continuous current.....1200 A

BIL.....110 kV

2.5.4.2 Standard Devices and Accessories

One set of special tools, as necessary for servicing, shall be provided.

2.5.4.3 Stick (Hook) Operated Line Switches

Stick (hook) operated line switches shall comply with ANSI C37.32 and shall be a stick-operated, single-pole, single-throw, vertical-break switch suitable for vertical mounting as indicating.

2.5.4.4 Group-Operated Line Switches

Group-operated line switches shall be with manual -type operators. Group-operated line switches shall comply with ANSI C37.32, IEEE ANSI/IEEE C37.30, IEEE ANSI/IEEE C37.34, and NEMA SG 6, and shall be three-pole, single-throw, provided with a mechanism which opens the three phases simultaneously. Group-operated switches shall be manually operated.

a. Manually-Operated Type, Air-Insulated:

The switch operating handle shall be located approximately 1.1 m above its grounded platform plate. Insulation of the switch operating mechanism shall include both insulated interphase rod sections and the insulated vertical shaft.

2.5.4.5 Grounded Iron Platform Plate

The manually-operated, group-operated switch shall be provided with a grounded platform plate located where the switch operator would stand to manually operate the switch. The plate shall be constructed of hot-dip galvanized iron at least 6 mm thick and shall be approximately 1.2 min length by 750 mm in width. The plate shall be laid on finished grade and so secured as shown. Two ground clamps shall be provided on the plate on the side adjacent to the switch operating mechanism. Each clamp shall be connected to the station grounding grid with a No. 4/0 AWG bare copper wire. Separate clamps and a flexible copper braid conductor shall be used to connect the plate to the switch operating handle mechanism. The cross sectional area of the braid shall be equivalent to a No. 4 AWG conductor, minimum.

2.6 thru 2.9 NOT USED

2.10 CABINETS AND ENCLOSURES

Cabinets and enclosures shall comply with NEMA 250 and shall be of galvanized steel, shall be provided with hinged doors, and shall be suitable for indoor or outdoor installation as indicated. Where locations are not indicated, cabinets shall be suitable for outdoor installation. Thickness of metal and outdoor construction shall be in accordance with UL 50. An indoor cabinet exterior shall have one finish coat and an outdoor cabinet exterior shall have two finish coats. Finish colors shall be manufacturer's standard dark gray or sky gray for outdoor cabinets and light gray for indoor cabinets, unless otherwise specified. The finish color of outdoor equipment shall be the same unless otherwise approved. Finish coats shall be applied over a prepared substrate. Each cabinet shall be a freestanding type or may be supported by attachment to an enclosure fence or a switchgear interior wall where located adjacent thereto. A concrete pad shall be provided to support any outdoor cabinet whose base extends to within 75 mm of grade level and pads shall extend at least 100 mm below grade.

2.11 MISCELLANEOUS

2.11.1 NOT USED
2.11.2 NOT USED

2.11.3 Wiring

Wiring between separate items of station equipment shall conform to the requirements 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Solid wiring may be used for convenience outlets, heating elements, and lighting circuits. Otherwise, the minimum class of stranding shall be Class C. Class K stranding shall be used for wiring between items of equipment mounted on swinging panels or doors and items mounted on fixed panels or parts of fixed assemblies. The insulation type shall be the type SIS unless otherwise specified, indicated, or proposed and approved for use. The minimum wire gauge shall be No. 14 AWG, except No. 18 AWG may be used for circuits that use one ampere or less. Circuits rated less than 115 volts ac or 125 volts dc may be wired with wiring rated 300 volts-to-ground. Otherwise, all wiring shall be rated for 600 volts ac and 250 volts dc Current transformer circuit wiring shall be not less than No. 10 AWG. Wiring for Close and Trip circuits shall be not less than No. 8 AWG. Wire markers shall be affixed to each end of wires and shall contain wire number or designations shown on contract or detail drawings, or as otherwise approved. Wire numbers shall also be permanently marked on terminal block marking strips where wires are connected. Only insulated-barrel, crimp-type, ring lugs shall be used.

2.11.4 Single-Line Electrical Diagram

A single-line electrical diagram of the station shall be provided showing new equipment. The diagram shall be enclosed between matte-surface thermoplastic sheets buttoned or otherwise suitably fastened together to allow easy access to the diagram for making any future changes. The diagram shall be suitable for outdoor mounting and shall be approximately 350 x 525 mm unless another size is approved. The diagram shall be attached with temperature- and moisture-resistant, pressure-sensitive adhesive or with other suitable means to the indicated location at the metal-clad switchgear lineup, except when otherwise shown or directed.

2.11.5 NOT USED
2.11.6 NOT USED

2.11.7 Concentric-Lay-Stranded Conductors

Copper conductors shall comply with ASTM B 8 for soft drawn copper. Equivalent aluminum conductors shall comply with ASTM B 231.

2.11.8 Conduits, Rigid Metal

Conduits shall comply with UL 6.

2.11.9 Hardware

Ferrous metal threaded items shall comply with ASTM A 153 and miscellaneous nonthreaded items shall comply with ASTM A 123. Other equivalent protective treatment, as required by ASTM A 123 or ASTM A 153, or ferrous metals designed to meet ASTM Standards covering corrosion-resisting steel, will be permitted if approved in writing.

2.11.10 Padlocks

Padlocks shall comply with ASTM F 883 and be specific to Ft. Campbell Electrical Maintenance Department.

2.11.11 NOT USED

2.12 GROUNDING AND BONDING

2.12.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to UL 467 not less than 15.9 mm in diameter by 3.1 m in length .

2.12.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as the phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.13 SURGE ARRESTERS

Surge arresters shall comply with NEMA LA 1, IEEE C62.1, IEEE C62.2, and IEEE C62.11, and shall be provided as indicated. Arresters shall be station class, rated as shown. Arresters shall be equipped with mounting brackets for the indicated installations. Arresters shall be of the metal-oxide varistor type suitable for outdoor installations.

2.14 COORDINATED POWER SYSTEM PROTECTION

Analyses shall be prepared to demonstrate that the equipment selected and system constructed meet the contract requirements for equipment ratings, coordination, and protection. They shall include a load flow analysis, a fault current analysis, and a protective device coordination study. The studies shall be performed by a registered professional engineer with demonstrated experience in power system coordination in the last three years. The Contractor shall provide a list of references complete with points of contact, addresses, and telephone numbers. The selection of the engineer is subject to the approval of the Contracting Officer.

2.14.1 Scope of Analyses

The fault current analysis, and protective device coordination study shall begin at: the source bus and extend down to system buses where fault availability is 10,000 amperes (symmetrical) for building/facility 600 volt level distribution buses.

2.14.2 Determination of Facts

The time-current characteristics, features, and nameplate data for each existing protective device shall be determined and documented. The Contractor shall coordinate with the Ft. Campbell DPW for fault current availability at the site.

2.14.3 Single Line Diagram

A single line diagram shall be prepared to show the electrical system buses, devices, transformation points, and all sources of fault current (including generator and motor contributions). A fault-impedance diagram or a computer analysis diagram may be provided. Each bus, device, or transformation point shall have a unique identifier. If a fault-impedance diagram is provided, impedance data shall be shown. Locations of switches, breakers, and circuit interrupting devices shall be shown on the diagram together with available fault data, and the device interrupting rating.

2.14.4 Fault Current Analysis

2.14.4.1 Method

The fault current analysis shall be performed in accordance with methods described in IEEE Std 242, and IEEE Std 399.

2.14.4.2 Data

Actual data shall be utilized in fault calculations. Bus characteristics and transformer impedances shall be those proposed. Data shall be documented in the report.

2.14.4.3 Fault Current Availability

Balanced three-phase fault, bolted line-to-line, and line-to-ground fault current values shall be provided at each voltage transformation point and at each power distribution bus. The maximum and minimum values of fault available at each location shall be shown in tabular form on the diagram or in the report.

2.14.5 Coordination Study

The study shall demonstrate that the maximum possible degree of selectivity has been obtained between devices specified, consistent with protection of equipment and conductors from damage from overloads and fault conditions. The study shall include a description of the coordination of the protective devices in this project. Provide a written narrative that describes: which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; situations where system coordination is not achievable due to device limitations (an analysis of any device curves which overlap); coordination between upstream and downstream devices; and relay settings. Recommendations to improve or enhance system reliability, and detail where such changes would involve additions or modifications to the contract and cost changes (addition or reduction) shall be provided. Composite coordination plots shall be provided on log-log graph paper.

2.14.6 Study Report

a. The report shall include a narrative describing: the analyses performed; the bases and methods used; and the desired method of coordinated protection of the power system.

b. The study shall include descriptive and technical data for existing devices and new protective devices proposed. The data shall include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices.

c. The report shall document utility company data including system voltages, fault MVA, system X/R ratio, time-current characteristic curves, current transformer ratios, and relay device numbers and settings; and existing power system data including time-current characteristic curves and protective device ratings and settings.

d. The report shall contain fully coordinated composite time-current characteristic curves for each bus in the system, as required to ensure coordinated power system protection between protective devices or equipment. The report shall include recommended ratings and settings of all protective devices in tabulated form.

e. The report shall provide the calculations performed for the analyses, including computer analysis programs utilized. The name of the software package, developer, and version number shall be provided.

2.15 FACTORY TESTS

Factory tests shall be performed, as follows, in accordance with the applicable publications and with other requirements of these specifications. The Contracting Officer shall be notified at least 10 days before the equipment is ready for testing. The Contracting Officer reserves the right to witness the tests.

a. Protective Relays: Seismic tests in accordance with IEEE ANSI/IEEE C37.98. Surge withstand tests in accordance with IEEE ANSI/IEEE C37.90.1.

b. Relaying Current Transformers: Manufacturer's standard tests in accordance with IEEE ANSI/IEEE C57.13.

C. Electrical Power Insulators: Manufacturer's standard tests in accordance with ANSI C29.1.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Circuits installed in conduits or underground and splices and terminations for medium-voltage cable shall conform to the requirements of Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Secondary circuits installed in conduit on poles shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall notify the Contracting Officer of any discrepancy before performing any work.

3.1.3 Concrete Foundations

3.1.3.1 NOT USED

3.1.3.2 Concrete Pads

Concrete pads for pad-mounted electrical equipment shall be constructed as indicated. Tops of concrete pads shall be level and shall project four inches above finished paving or grade and sloped to drain.

Conduits for primary, secondary, and grounding conductors shall be set in place prior to placing of concrete pads. Concrete work shall comply with the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. If the equipment primary compartment is not of sufficient height to allow the installation of the medium-voltage terminators, load break elbows or switches, the Contractor shall provide adequate space by providing a rectangular hole in the concrete pad below the primary compartment and/or a factory prefabricated steel adjustment ring around the entire perimeter of the base of the equipment. Steel rings shall be factory manufactured to fit the base of the equipment of which they support and shall be factory painted to match the equipment enclosure. Steel base rings shall be constructed using the same or greater thickness of steel as the equipment being supported. Concrete pads to support pad mounted electrical equipment shall be reinforced per equipment manufacturer recommendation. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment housing with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, and foreign matter.

3.1.4 NOT USED
3.1.5 NOT USED
3.1.6 NOT USED
3.1.7 NOT USED

3.1.8 Field Welding

Procedures and welders shall be qualified in accordance with AWS D1.1 for structural welding and ASME BPV IX for welding of equipment. Welding procedures qualified by others, and welders and welding operators qualified by a previously qualified employer maybe accepted as permitted by ASME B31.3. the Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practical. The Contracting Officer shall be provided with a copy of qualifying procedures and a list of names and identification symbols of qualified welders and welding operators. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section 05055 WELDING, Structural. Gas-metal arc welding shall be performed by welders certified to perform gas-metal arc welding.

3.1.9 Connections to Utility Lines

The Contractor shall coordinate the work with the Contracting Officer and shall provide final connections to the utility electric lines.

3.1.10 NOT USED

3.2 EQUIPMENT INSTALLATION

3.2.1 NOT USED

3.2.2 Equipment Finishes

Equipment shall be carefully installed so as not to scratch finishes. After installation, finished surfaces shall be inspected and scratches touched up with a finish provided by the manufacturer especially for this purpose.

3.2.3 Supports

Enclosures and enclosure supports shall be installed in accordance with manufacturer's instructions. Supports shall consist of anchored channels leveled and then embedded in the concrete foundation. Channels, anchors, shims, or other leveling items shall be installed in accordance with the recommendations of the equipment manufacturer.

3.2.4 Switch Leveling

After leveling items are correctly installed, switchgear lineups shall be out-of-plumb by not more than 6 mm for the entire length and width. Insertion or withdrawal of removable elements shall be easily accomplished, and component devices shall operate properly after the switchgear assembly is completely installed.

3.2.5 NOT USED
3.2.6 NOT USED

3.3 ELECTRICAL BUS CONNECTIONS

All connections to aluminum bus shall be cleaned and coated with an inhibiter in accordance with manufacturer's recommended methods. All bolted connections shall be torqued to the correct tightness. The Contractor shall establish a checklist to insure that bolted connections have been properly coated and correctly torqued. All welded connections on aluminum buswork shall be by the gas metal-arc welding process. The shield inert gas shall be argon. The welder shall be certified for gas metal-arc welding.

3.4 GROUNDING

The breaker shall be connected to the existing grounding grid. Grounding grid shall comply with IEEE Std 80. Equipment frames of metal-enclosed equipment, medium-voltage cable terminations, metal-structures, and other non-current carrying metal items shall be connected to the ground grid as shown. At least two connections shall be provided from the vacuum breaker enclosure and a grounded iron platform plate to the ground grid.

3.4.1 Grounding Electrodes

Grounding electrodes shall be as follows:

a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately one foot below finished grade.

b. Grid grounding electrodes - A grid grounding electrode shall be installed as shown consisting of bare copper conductors installed 300 mm plus or minus 75 mm below the finished top of soil grade. Grid conductors shall be bonded to all rod electrodes, and to all other intersecting grid conductors. Grid conductors shall be sized as shown.

3.4.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by the fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

3.4.3 Grounding and Bonding Conductors

Grounding and bonding conductors include all conductors used to bond transformer enclosures, equipment frames and structural members to the grounding grid. Grounding and bonding conductors

shall be sized as shown. After being located to provide maximum physical protection, exposed grounding conductors shall be securely attached to structural supports at not more than two foot intervals with suitable fasteners. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete should be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

3.4.4 NOT USED

3.5 FIELD TESTING

3.5.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 30 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports will be signed and dated by the Contractor.

3.5.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.5.3 Ground-Resistance Tests

The resistance of each grounding electrode the grounding grid shall be measured using the fall-of-potential method defined in IEEE Std 81. Soil resistivity in the area of the grid shall be measured concurrently with the grid measurements. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

a. Single rod electrode - 25 ohms.

b. Grid electrode - per existing substation data.

3.5.4 Ground-Grid Connection Inspection

All below-grade ground-grid connections will be visually inspected by the Contracting Officer before backfilling. The Contractor shall notify the Contracting Officer 30 hours before the site is ready for inspection.

3.5.5 NOT USED
3.5.6 NOT USED

3.5.7 Circuit Interrupter Switch Tests

The following field tests shall be performed on circuit interrupters.

a. Insulation resistance test phase-to-phase.

b. Insulation resistance test phase-to-ground.

c. Closed contact resistance test.

d. Power factor test.

e. High-potential test.

f. Manual and electrical operation of the switch.

3.5.8 Protective Relays

Protective relays shall be visually and mechanically inspected, adjusted, tested, and calibrated in accordance with the manufacturer's published instructions. Tests shall include pick-up, timing, contact action, restraint, and other aspects necessary to insure proper calibration and operation. Relay settings shall be implemented in accordance with the coordination study. Relay contacts shall be manually or electrically operated to verify that the proper breakers and alarms initiate. Relaying current transformers shall be field tested in accordance with IEEE ANSI/IEEE C57.13.

3.5.9 Pre-Energization Services

Calibration, testing, adjustment, and placing into service of the installation shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of two years of current product experience. No part of the electrical system shall be energized until all station grounding components have been tested and demonstrated to comply with the specified requirements. The following services shall be performed on the equipment listed below. These services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to insure that installation is in compliance with the recommendations of the manufacturer and as shown on the detail drawings. Terminations of conductors at station buses and at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage caused during installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage during installation or shipment and to verify that packaging materials have been removed. Components capable of being both manually and electrically operated shall be operated manually prior to the first electrical operation. Components capable of being calibrated, adjusted, and tested shall be calibrated, adjusted, and tested in accordance with the instructions of the equipment manufacturer. Items for which such services shall be provided include, but are not limited to, are the following:

Breakers, circuit.

Buses, metal-enclosed.

Buses, station aerial.

Switches, disconnect with power fuses.

Switches, air-break.

3.5.10 Operating Tests

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the requirements herein. An operating test report shall be submitted in accordance with paragraph TEST REPORTS.

3.6 MANUFACTURER'S FIELD SERVICE

3.6.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 16 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHS format video tape of the entire training session shall be submitted.

3.6.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of the equipment, assist in the performance of the onsite tests, initial operation, and instruct personnel as to the operational and maintenance features of the equipment.

3.7 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation material or operation have been corrected.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.		
TITLE AND LOCATION DISCOM Barracks Complex Phase 1, Fort Campbell, KY				CONTRACTOR									SPEC. SECTION 16311		
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION				
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.		
			PAR. NO. 1.3 SUBMITTALS												
			SD-01 Data												
		1	Fault Current and Protective Devices Coordination Studies; GA.												
		2	Manufacturer's Catalog; GA.												
		3	Material, Equipment, and Fixture Lists; GA.												
		4	Installation Procedures; FIO.												
			SD-04 Drawings												
		5	Electrical Supply Station; GA.												
		6	As-Built Drawings; FIO.												
			SD-08 Statements												
		7	On-Site Test; GA.												
			SD-09 Reports												
		8	Factory Test Reports; GA.												
		9	Field Test Plan; GA.												
		10	Field Test Reports; GA.												
			SD-13 Certificates												
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SECTION 16375

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(1995) Code for Electricity Metering
ANSI C12.4	(1984; R 1990) Mechanical Demand Registers
ANSI C12.10	(1987) Electromechanical Watthour Meters
ANSI C12.11	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
ANSI C29.1	(1988) Electrical Power Insulators - Test Methods
ANSI C37.46	(1981; R 1992) Power Fuses and Fuse Disconnecting Switches
ANSI C37.72	(1987) Manually-Operated Dead-Front, Padmounted Switchgear with Load-Interrupting Switches and Separable Connectors for Alternating-Current Systems
ANSI C57.12.28	(1988) Switchgear and Transformers - Padmounted Equipment - Enclosure Integrity
ANSI C80.1	(1990) Rigid Steel Conduit - Zinc Coated
ANSI C119.1	(1986) Sealed Insulated Underground Connector Systems Rated 600 Volts

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(1994a) Gray Iron Castings
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153	(1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B 8	(1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM B 117	(1994) Operating Salt Spray (Fog) Testing Apparatus
ASTM C 478	(1994) Precast Reinforced Concrete Manhole Sections
ASTM D 923	(1991) Sampling Electrical Insulating Liquids
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 4059	(1991) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography
ASTM F 883	(1990) Padlocks

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5	(1994) Specifications for Cross-linked Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 kV
AEIC CS6	(1987; Rev Mar 1989) Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 Through 69 kV

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825	(1995; Supple I; Supple II; Supple III) Approval Guide

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
IEEE C37.2	(1991) Electrical Power System Device Function Numbers
IEEE C37.20.1	(1993) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
IEEE C37.20.2	(1993; C37.20.2b) Metal-Clad and Station-Type Cubicle Switchgear
IEEE C37.20.3	(1987) Metal-Enclosed Interrupter Switchgear
IEEE C37.30	(1992) Definitions and Requirements for High-Voltage Air Switches, Insulators, and Bus Supports
IEEE C37.90	(1989) Relays and Relay Systems Associated with Electric Power Apparatus
IEEE C37.90.1	(1989; R 1991) IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems
IEEE C37.98	(1987; R 1991) Seismic Testing of Relays
IEEE C57.12.00	(1993) IEEE Standard General Requirements for Liquid -Immersed Distribution, Power, and Regulating Transformers

IEEE C57.13	(1993) Instrument Transformers
IEEE C62.1	(1989; R 1994) Surge Arresters for ac Power Circuits
IEEE C62.2	(1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems
IEEE C62.11	(1993) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits
IEEE Std 48	(1996) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 100	(1992) IEEE Standard Dictionary of Electrical and Electronics Terms
IEEE Std 242	(1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE Std 399	(1990) Recommended Practice for Industrial and Commercial Power System Analysis
IEEE Std 404	(1993) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V through 46 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V
IEEE Std 590	(1977; R 1991) IEEE Cable Plowing Guide
IEEE Std 592	(1990) Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches
NEMA BU 1	(1994) Busways
NEMA FB 1	(1993) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit and Cable Assemblies
NEMA LA 1	(1992) Surge Arresters
NEMA SG 2	(1993) High Voltage Fuses
NEMA TC 5	(1990) Corrugated Polyolefin Coilable Plastic Utilities

	Duct
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA TC 7	(1990) Smooth-Wall Coilable Polyethylene Electrical Plastic Duct
NEMA WC 7	(1993) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8	(1993) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
	NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
NFPA 70	(1996) National Electrical Code
	UNDERWRITERS LABORATORIES (UL)
UL 6	(1993; Rev March 96) Rigid Metal Conduit
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 467	(1993; Rev thru Aug 1996) Grounding and Bonding Equipment
UL 486A	(1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1991; Rev thru Oct 1996) Wire Connectors for Use with Aluminum Conductors
UL 489	(1996) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
UL 510	(1994) Insulating Tape
UL 514A	(1996) Metallic Outlet Boxes
UL 651	(1995) Schedule 40 and 80 Rigid PVC Conduit
UL 854	(1996; Rev May 1996) Service-Entrance Cables
UL 857	(1994; Rev Oct 1994) Busways and Associated Fittings
UL 1242	(1996) Intermediate Metal Conduit
UL 1684	(1993) Reinforced Thermosetting Resin Conduit

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

1.2.2 Service Conditions

Items provided under this section shall be specifically suitable for the following service conditions: Seismic Zone 2.

1.3 SUBMITTALS

Governmental approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Fault Current and Protective Devices Coordination Studies; GA.

The study shall be submitted with protective device equipment submittals. Not time extension or similar contract modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed shall be based on recommendations of this study. The Government shall not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

Manufacturer's Catalog Data; FIO.

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists; FIO.

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each such item.

Installation Procedures; FIO.

As a minimum, installation procedures for transformers, substations, switchgear, and medium-voltage cable terminations and splices.

Procedures shall include cable pulling plans, diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

SD-04 Drawings

Electrical Distribution System; GA.

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams manufacturers standard installation drawings and other information necessary to define the installation and enable the Government to check conformity with the requirements of the contract drawings.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures shall be included with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Detail drawings shall show how components are assembled, function together and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall consist of the following:

a. Detail drawings showing physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. All optional items shall be clearly identified as included or excluded.

b. Internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

Detail drawings shall as a minimum depict the installation of the following items:

a. Medium-voltage cables and accessories including cable installation plan.

b. Transformers.

c. Transclosures.

d. Pad-mounted loadbreak switches.

e. Busways.

f. Surge arresters.

SD-09 Reports

Factory Test; FIO.

Certified factory test reports shall be submitted when the manufacturer performs routine factory tests, including tests required by standards listed in paragraph REFERENCES. Results of factory tests performed shall be certified by the manufacturer, or an approved testing laboratory, and submitted within 7 days following successful completion of the tests. The manufacturer's pass-fail criteria for tests specified in paragraph FIELD TESTING shall be included.

Field Testing; GA.

A proposed field test plan, 20 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Test Reports; GA.

Six copies of the information described below in 215.9 by 279.4 mm (8-1/2 by 11 inch) binders having a minimum of three rings, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The condition specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

Cable Installation Reports; GA.

Six copies of the information described below in 215.9 by 279.4 mm (8-1/2 by 11 inch) binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

a. Site layout drawing with cable pulls numerically identified.

b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.

c. The cable manufacturer and type of cable.

d. The dates of cable pulls, time of day, and ambient temperature.

e. The length of cable pull and calculated cable pulling tensions.

f. The actual cable pulling tensions encountered during pull.

SD-13 Certificates

Materials and Equipment; FIO.

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

Cable Splicer Qualification; FIO.

A certification that contains the names and the qualifications of people recommended to perform the splicing and termination of medium-voltage cables approved for installation under this contract. The certification shall indicate that any person recommended to perform actual splicing and terminations has been adequately trained in the proper techniques and have had at least three recent years of experience in splicing and terminating the same or similar types of cables approved for installation. In addition, any person recommended by the Contractor may be required to perform a practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage cables. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables along with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types.

Cable Installer Qualifications; FIO.

The Contractor shall provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. A resume shall be provided showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers.

SD-19 Operation and Maintenance Manuals

Electrical Distribution System; GA.

Six copies of operation and maintenance manuals, within 7 calendar days following the completion of tests and including assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

Three additional copies of the instructions manual shall be provided within 30 calendar days following the manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements. Wood poles held in storage for more than 2 weeks shall be stored in accordance with ANSI O5.1. Handling of wood poles shall be in accordance with ANSI O5.1, except that pointed tools capable of producing indentations more than 25 mm in depth shall not be used. Metal poles shall be handled and stored in accordance with the manufacturer's instructions.

1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the contracting officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable toolbox. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 NAMEPLATES

2.2.1 General

Each major component of this specification shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of noncorrosive metal. Equipment containing liquid dielectrics shall have the type of dielectric on the nameplate. Sectionalizer switch nameplates shall have a schematic with all switch positions shown and labeled. As a minimum, nameplates shall be provided for transformers, circuit breakers, meters, switches, and switchgear.

2.2.2 Liquid-Filled Transformer Nameplates

Power transformers shall be provided with nameplate information in accordance with IEEE C57.12.00. Nameplates shall indicate the number of liters and composition of liquid-dielectric, and shall be permanently marked with a statement that the transformer dielectric to be supplied is non-polychlorinated biphenyl. If transformer nameplate is not so marked, the Contractor shall furnish manufacturer's certification for each transformer that the dielectric is non-PCB classified, with less than 50 ppm PCB content in accordance with paragraph LIQUID DIELECTRICS. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 50 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

2.3 CORROSION PROTECTION

2.3.1 Aluminum Materials

Aluminum shall not be used.

2.3.2 Ferrous Metal Materials

2.3.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153 and ASTM A 123.

2.3.2.2 Equipment

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaries not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1.6 mm (1/16 inch) from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.3.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in Section 09900 PAINTING, GENERAL.

2.4 CABLES

Cables shall be single conductor type unless otherwise indicated.

2.4.1 Conductor Material

Underground cables shall be of soft drawn copper conductor material.

2.4.2 Medium-Voltage Cables

2.4.2.1 General

Cable construction shall be concentric neutral underground distribution cable conforming to AEIC CS5 and NEMA WC 7. Cables shall be manufactured for use in duct applications.

2.4.2.2 Insulation

Cables shall utilize cross-linked thermosetting polyethylene (XLP) insulation conforming to the requirements of NEMA WC 7 and AEIC CS5. A 133 percent insulation level shall be used on 5 kv, 15 kv and 25 kv rated cables.

2.4.2.3 Jackets

Cables shall be provided with a nonmetallic jacket. Concentric neutral cables for direct buried applications shall have a moisture-resistant, nonmetallic jacket rated for direct burial.

2.4.2.4 Neutrals

Neutral conductors of grounded neutral systems except for concentric neutral cables shall be of the same insulation material as phase conductors, except that a 600-volt insulation rating is acceptable. Concentric neutrals conductors shall be tinned copper, having a combined ampacity equal to the phase conductor ampacity rating.

2.4.2.5 Shielding

Cables rated for above 2 kV shall have both conductor and insulation shielding for each phase, except insulation shielding is not required for 5 kV armored or metallic-sheathed cable.

2.4.2.6 Ratings

Medium-voltage cables shall be rated for a circuit voltage of 15 kV.

2.4.3 Low-Voltage Cables

Cables shall be rated 600 volts and shall conform to the requirements of NFPA 70. Cables shall utilize ethylene-propylene-rubber (EPR) insulation and shall conform to the requirements of NEMA WC 8.

2.4.3.1 NOT USED

2.4.3.2 In Duct

Cables shall be single-conductor cable, Type RHW, THW, THWN, TW, USE, or XHHW in accordance with NFPA 70. Cables in factory-installed, coilable-plastic-duct assemblies shall conform to NEMA TC 5 or NEMA TC 7.

2.5 CABLE JOINTS, TERMINATIONS, AND CONNECTORS

2.5.1 Medium-Voltage Cable Joints

Medium-voltage cable joints shall comply with IEEE Std 404 and IEEE Std 592. Medium-voltage cable terminations shall comply with IEEE Std 48. Joints shall be the standard products of a manufacturer and shall be either of the factories preformed type or of the kit type containing tapes and other required parts. Joints shall have ratings not less than the ratings of the cables on which they are installed. Splice kits may be of the heat-shrinkable type for voltages up to 15 kV, of the premolded splice and connector type, the conventional taped type, or the resin pressure-filled overcast taped type for voltages up to 35 kV; except that for voltages of 7.5 kV or less a resin pressure-filled type utilizing a plastic-tape mold is acceptable. Joints used in manholes, handholes, vaults and pull boxes shall be certified by the manufacturer for waterproof, submersible applications.

2.5.2 NOT USED

2.5.3 Low-Voltage Cable Splices

Low-voltage cable splices and terminations shall be rated at not less than 600 Volts. Splices in conductors No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in conductors No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A and UL 486B. Splices shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

2.5.4 Terminations

Terminations shall be in accordance with IEEE Std 48, Class 1 or Class 2; of the molded elastomer, wet-process porcelain, prestretched elastomer, heat-shrinkable elastomer, or taped type. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, and armor.

2.5.4.1 Factory Preformed Type

Molded elastomer, wet-process porcelain, prestretched, and heat-shrinkable terminations shall utilize factory preformed components to the maximum extent practicable rather than tape build-up. Terminations shall have basic impulse levels as required for the system voltage level.

2.5.4.2 Taped Terminations

Taped terminations shall use standard termination kits providing terminal connectors, field-fabricated stress cones, and rain hoods. Terminations shall be at least 510 long from the end of the tapered cable jacket to the start of the terminal connector, or not less than the kit manufacturer's recommendations, whichever is greater.

2.6 CONDUIT AND DUCTS

Duct lines shall be concrete-encased, thin-wall type. Where concrete encasement is not required, low-voltage circuits may utilize factory-installed cable in coilable plastic duct.

2.6.1 Metallic Conduit

Intermediate metal conduit shall comply with UL 1242. Rigid galvanized steel conduit shall comply with UL 6 and ANSI C80.1. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1.

2.6.2 Nonmetallic Ducts

2.6.2.1 NOT USED

2.6.2.2 Concrete Encased Ducts

UL 651 Schedule 40.

2.6.2.3 Direct Burial

UL 65 Schedule 40 and Schedule 80, or NEMA TC 6 Type DB.

2.6.3 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 2 degrees C (35 degrees F), shall neither slump at a temperature of 150 degrees C (300 degrees F), nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

2.7 MANHOLES, HANDHOLES, AND PULLBOXES

Manholes, handholes, and pullboxes shall be as indicated. Strength of manholes, handholes, and pullboxes and their frames and covers shall conform to the requirements of IEEE C2. Precast-concrete manholes shall have the required strength established by ASTM C 478. Frames and covers shall be made of gray cast iron and a machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with ASTM A 48, Class 30B, minimum. Handholes for low voltage cables installed in parking lots, sidewalks, and turfed areas shall be fabricated from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least 69 MPa (10,000 psi) and a flexural strength of at least 34.5 MPa (5000 psi) Pullbox and handhole covers in sidewalks, and turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

2.8 POLES AND HARDWARE

2.8.1.1 Wood Poles

Wood poles shall comply with ANSI O5.1, and shall be pressure treated in accordance with AWPA C4, with creosote conforming to AWPA P1/P13or with oil-borne preservatives and petroleum conforming to AWPA P8 and AWPA P9, respectively, and waterborne preservatives conforming to AWPA P5. Waterborne preservatives shall be either chromated or ammoniacal copper arsenate. Any species listed in ANSI O5.1 for which a preservative treatment is not specified in AWPA C4, shall not be used; northern white cedar, if treated as specified for western red cedar, and western fir, if treated as specified for Douglas fir, may be used. Wood poles shall have pole markings located approximately 3 m 10 feet from pole butts for poles 15.2 m or less in length. Poles shall be machine trimmed by turning smooth full length, and shall be roofed, gained, and bored prior to pressure treatment. Where poles are not provided with factory-cut gains, metal gain plates shall be provided.

2.8.1.2 Pole Line Hardware

Zinc-coated hardware shall comply with ANSI C135.1, ANSI C135.2, ANSI C135.4, ANSI C135.14 ANSI C135.22. Steel hardware shall comply with ASTM A 575 and ASTM A 576. Hardware shall be hot-dip galvanized in accordance with ASTM A 153. Pole-line hardware shall be hot-dip galvanized steel. Washers shall be installed under boltheads and nuts on wood surfaces and elsewhere as required. Washers used on through-bolts and double-arming bolts shall be approximately 57.2 mm square and 4.8 mm thick. The diameter of holes in washers shall be the correct standard size for the bolt on which a washer is used. Washers for use under heads of carriage-bolts shall be of the proper size to fit over square shanks of bolts. Eye bolts, bolt eyes, eyenuts, strain-load plates, lag screws, guy clamps, fasteners, hooks, shims, and clevises shall be used wherever required to support and to protect poles, brackets, crossarms, guy wires, and insulators.

2.8.1.3 Guy Assemblies

Guy assemblies shall be copper-clad steel in accordance with ASTM B 228. Guy assemblies, including insulators and attachments, shall provide a strength exceeding the required guy strength. Three-eye thimbles shall be provided on anchor rods to permit attachment of individual primary, secondary, and communication down guys. Anchors shall provide adequate strength to support all loads. Guy strand shall be 7 strand. Guy material shall be Class 30 EHS copper-clad steel extra-high-strength grade, with a minimum breaking strength as shown, except where two or more guys are used to provide the required strength. Guy rods shall be not less than 2.1 m in length by 25.4 mm in diameter.

2.8.2 INSULATORS

Insulators shall comply with NEMA HV 2 for general requirements. Suspension insulators shall be used at corners, angles, dead-ends, other areas where line insulators do not provide adequate strength, and as indicated. Mechanical strength of suspension insulators and hardware shall exceed the rated breaking strength of the attached conductors.

2.8.2.1 Medium-Voltage Line Insulators

Medium-voltage line insulators shall comply with ANSI C29.2, ANSI C29.5, and ANSI C29.6, and as applicable. Ratings shall not be lower than the ANSI classes indicated in TABLE I. Horizontal line-post insulators shall be used for armless construction and shall have the same mechanical and electrical ratings as vertical line-post insulators for the ANSI class indicated, but shall be modified to be suitable for horizontal installation. Where line-post insulators are used for angles greater than 15 degrees, clamp-top fittings shall be provided as well as for other locations shown. Conductor clamps for use with clamp-top, line-post insulators shall be hot-dip galvanized malleable iron for copper conductors and aluminum alloy for aluminum-composition conductors. Either line-post or pin insulators may be used for crossarm construction. Pin insulators for use on voltages in excess of 6 kV phase-to-phase shall be radio-interference-freed or else line-post insulators shall be used.

TABLE I

MINIMUM ANSI RATING OF MEDIUM-VOLTAGE INSULATORS BY CLASS

Voltage Level	Line-Post	Pin	Suspension
6 kV to 15 kV	57-1 or 11 57-2 or 12	55-5 56-3	Two 52-2 Two 52-3 or 4

2.8.2.2 Strain Insulators for Guy Wires

Strain insulators for use in insulated guy assemblies shall comply with ANSI C29.4 for porcelain or equivalent fiberglass, and shall have a mechanical strength exceeding the rated breaking strength of the attached guy wire. Insulators shall be not smaller than 54-2 for lines of 6 kV to 15 kV.

2.8.2.3 Apparatus Insulators

Apparatus insulators shall comply with IEEE ANSI/IEEE C57.19.00, IEEE ANSI/IEEE C57.19.01, ANSI C29.8, and ANSI C29.9 as applicable.

2.8.3 CROSSARM ASSEMBLIES

2.8.3.1 Crossarms

Crossarms shall comply with RUS REA Bulletin 1728H-701 and shall be solid wood, distribution type, except cross-sectional area with pressure treatment conforming to AWPA C25, and a 6.4 mm, 45 degree chamfer on all top edges. Cross-sectional area minimum dimensions shall be 108.0 mm in height by 82.6 mm in depth in accordance with IEEE C2 for Grade B construction. Crossarms shall be 2.4 m in length, except that 3.1 m crossarms shall be used for crossarm-mounted banked single-phase transformers or elsewhere as indicated. Crossarms shall be machined, chamfered, trimmed, and bored for stud and bolt holes before pressure treatment. Factory drilling shall be provided for pole and brace mounting, for four pin or four vertical line-post insulators, and for four suspension insulators, except where otherwise indicated or required. Drilling shall provide required climbing space and wire clearances. Crossarms shall be straight and free of twists to within 2.5 mm per 304.8 mm of length. Bend or twist shall be in one direction only.

2.9 ENCLOSED TRANSFORMER STATIONS:

2.9.1 General: Transformer stations shall be of ratings and arrangements as indicated and shall be the outdoor type. The voltage ratings of potheads, wiring, insulators, and cables for use on primary systems operating at 7,300 to 14,000 volts between phases shall be not less than 15,000 volts. Voltage ratings may be for grounded-neutral service when used on grounded-neutral systems.

2.9.1.1 Outdoor Stations: Transformers shall be mounted in a modular steel transclosure mounted on a concrete mat. Unless otherwise indicated the concrete mat shall be at least 203 mm thick, reinforced with a 152- by 152-mm No. 6 mesh and with a 152 mm well compacted gravel subbase. The top of the concrete mat shall be approximately 102 mm above the finished grade. The mat shall be of adequate size to project at least 203 mm beyond the equipment, with a 305 mm minimum clear space between transformers. Concrete mat shall be Class B or 2,500 psi at 28 days and shall conform to SECTION: CONCRETE FOR BUILDING CONSTRUCTION. The transclosure shall be adequately grounded and connected to the transformer-station ground system as shown on the drawings.

2.9.2 Primary connections shall be of the type and capacity indicated. The ends of conduits within the station shall be equipped with suitable termination. Spare conduits shall be capped. High-voltage insulators of applicable type and method of mounting or heavy-duty secondary racks, shall be installed as required to properly support open

wiring. Unless otherwise indicated, the distance between supports shall not exceed 1.2 meters. Insulator fittings for insulated wire or cable shall be designed to fit tightly over the insulation and covering, and no part of the insulation or braid shall be removed at these points.

2.9.3 Transformers shall conform to NEMA TR 1 except as modified by Fed. Spec. W-T-631 and as modified herein. Transformers shall be Type I, mineral-oil-insulated two winding type, and in accordance with the requirements hereinafter stated. Transformers shall be suitable in every respect for outdoor installation and rated as indicated. Transformers shall be the product of a manufacturer who has produced units of the same type, rating, and voltage, as required for this project, within the 3-year period preceding the date of the invitation for bids and shall be transformers that have operated satisfactorily for at least 1 year prior to date of the invitation for bids. Evidence showing such production and satisfactory performance and proved reliability of the product shall be promptly submitted to the Contracting Officer upon request therefor. All transformers shall be provided with rated KVA NEMA standard taps. High-voltage bushings shall be of the cover type. Low-voltage bushings shall be of the tank-wall type and mounted singly.

2.9.4 Standard Impulse-test Procedure: The high-voltage winding of each transformer rated above 167 KVA shall be impulse-rated in conformance with NEMA TR 1. Prior to final acceptance of the transformer by the Contracting Officer, the Contractor shall submit for approval the manufacturer's impulse-test data and shall be submitted similarly as shown in NEMA TR 1, and as required above. Transformer tank shall have a standard gray finish. Transformers shall be completed with all accessory equipment in accordance with the NEMA Standard. Each transformer shall have its KVA rating conspicuously displayed on its tank.

2.9.5 Transformer enclosure shall be of modular construction. Doors shall be hinged inside and shall have 3 point latching. Screened ventilating openings shall be provided and shall be suitable for installation in a public place with fencing and shall be tamper resistant. Enclosure shall be constructed of 12 gauge carbon steel. Enclosure shall have dark green baked enamel finish. Enclosure shall be assembled and securely anchored to pad. Equipment rails, clips, and accessories shall be provided within enclosure to mount and support equipment as indicated. The enclosure shall include caution signs on the exterior, which read "DANGER - HIGH VOLTAGE".

2.9.6 Wiring: The enclosure shall be wired with all the apparatus shown on the drawings and in the manner shown. The Contractor shall take care to insure that all the necessary clearances as required by the National Electrical Safety Code are maintained. The cable shall be trained and supported in a neat manner.

2.9.7 Grounding: Grounding shall be in accordance with paragraph 2.12 entitled "Grounding and Bonding" and paragraph 3.10 entitled "Grounding".

2.9.8 Primary Switching Equipment:

2.9.8.1 General: The primary switching equipment shall consist of an assembly of a three-pole, externally group-operated load-break air switches and one power fuse compartment within the pad mounted transformer enclosure, with cable entry through the bottom. The assembly shall be arranged as described on the drawings. Submit shop drawings of the primary switching equipment to the Contracting Officer for approval.

2.9.8.2 Grounding studs shall be provided at all fuse terminals and cable terminating compartment terminals, plus a stud on grounding pad in each fuse terminal and cable terminating compartment.

2.9.8.3 The primary switches shall be group operated air break design, with quick make, quick break mechanism to control the switching blade speed independently of operator handle speed, and utilizing arc compressors or chutes to control circuit interruption without external arc or flame. Switches shall be 600 amp continuous and interrupting with three phase fault closing ratings of 12,500 amps RMS symmetrical for one time duty cycle. One time duty cycle fault closing rating is the fault current into which the switch can be closed one time and then remain operable with the capability of carrying and interrupting rated continuous current.

2.9.8.4 The switch compartment shall be equipped with three power fuses and the necessary buswork, mounting hardware, terminal pads and cable termination space. The power fuses shall use a solid material arc extinguishing medium for low energy release and low gas generation during circuit interruption. The switch compartment shall be equipped with a storage rack and one set of spare fuse refill units, as well as a fuse handling tool.

2.9.8.5 Surge arresters shall be provided as indicated. Selection of arrester ratings and classification according to use shall be as described by NEMA LA 1. Arresters shall be equipped with suitable mounting brackets for the applicable method of mounting. They shall be grounded in accordance with paragraph 3.10.4 entitled "Surge-arrester Grounding".

2.10 METERING AND PROTECTIVE DEVICES

2.10.1 Circuit Breakers, Low-Voltage

2.10.1.1 NOT USED

2.10.1.2 Molded-Case Circuit Breakers

NEMA AB 1 and UL 489.

2.10.2 Fuses, Medium-Voltage, Including Current-Limiting

2.10.2.1 Construction

Units shall be suitable for outdoor use. Fuses shall have integral blown-fuse indicators. All ratings shall be clearly visible.

2.10.2.2 Ratings

Expulsion-type power fuses shall have ratings in accordance with ANSI C37.46 and as follows:

Nominal voltage .....12.47kv.

Rated maximum voltage .....15kv.

Rated continuous current .....As indicated.

2.10.2.3 NOT USED

2.10.2.4 NOT USED

2.10.3 Fuses, Low-Voltage, Current-Limiting

Low-voltage fuses shall conform to NEMA FU 1. Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilizes fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination.

2.10.3.1 NOT USED

2.10.3.2 Transformer Circuit Fuses

Transformer circuit fuses shall be Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.

2.10.4 Instrument Transformers

2.10.4.1 General

Instrument transformers shall comply with ANSI C12.11 and IEEE C57.13. Instrument transformers shall be configured for mounting in/on the device to which they are applied. Polarity marks on instrument transformers shall be visually evident and shown on drawings.

2.10.5 Watthour Meters

Watthour meters shall comply with ANSI C12.1 and ANSI C12.10, except that numbered terminal wiring sequence and case size may be the manufacturer's standard. Watthour meters shall be of the weatherproof type, suitable for mounting on outside of the transclosure. Watthour meters shall have a 15 minute, cumulative form, demand register meeting ANSI C12.4 and provided with not less than 2-1/2 stators. Watthour demand meters shall have factory-installed electronic pulse initiators meeting the requirements of ANSI C12.1. Pulse initiators shall be solid-state devices incorporating light-emitting diodes, phototransistors, and power transistors, except that mercury-wetted output contacts are acceptable. Initiators shall be totally contained within watthour demand meter enclosures. They shall be capable of operating at speeds up to 500 pulses per minute with no false pulses, and they shall be factory calibrated with no field adjustments being required. Initiators shall be calibrated for a pulse rate output of 1 pulse per 1/4 disc revolution of the associated meter and shall be compatible with the indicated equipment.

2.10.6 NOT USED

2.11 SURGE ARRESTERS

Surge arresters shall comply with NEMA LA 1, IEEE C62.1, IEEE C62.2, and IEEE C62.11 and shall be provided where indicated. Arresters shall be distribution class, rated as shown. Arresters for use at elevations in excess of 1.8 km (6000 feet) above mean sea level shall be specifically rated for that purpose. Arresters shall be equipped with mounting brackets suitable for the indicated installations. Arresters shall be of the valve or metal-oxide varistor or combination valve-metal-oxide varistor type.

2.12 GROUNDING AND BONDING

2.12.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to UL 467 not less than 19 mm (3/4 inch) in diameter by 3.1 m (10 feet) in length. Sectional type rods may be used.

2.12.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.13 CONCRETE AND REINFORCEMENT

Concrete work shall have minimum 20 MPa compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete reinforcing shall be as specified in Section 03200 CONCRETE REINFORCEMENT.

2.14 PADLOCKS

Padlocks shall conform to ASTM F 883, Type EPC, size 2.

2.15 CABLE FIREPROOFING SYSTEMS

Cable fireproofing systems shall be listed in FM P7825 as a fire-protective coating or tape approved for grouped electrical conductors and shall be suitable for application on the type of medium-voltage cables provided. After being fully cured, materials shall be suitable for use where exposed to oil, water, gases, salt water, sewage, and fungus and shall not damage cable jackets or insulation. Asbestos materials are not acceptable.

2.15.1 Fireproof Coating

Cable fireproofing coatings shall be compounded of water-based thermoplastic resins, flame-retardant chemicals, and inorganic noncombustible fibers and shall be suitable for the application methods used. Coatings applied on bundled cables shall have a derating factor of less than 5 percent, and a dielectric strength of 95 volts per mil minimum after curing.

2.15.2 Fireproofing Tape

Fireproofing tape shall be at least 50 mm (2 inches) wide and shall be a flexible, conformable, polymeric, elastomer tape designed specifically for fireproofing cables.

2.15.3 Plastic Tape

Preapplication plastic tape shall be pressure sensitive, 0.254 mm (10 mil) thick, conforming to UL 510.

2.16 LIQUID DIELECTRICS

Liquid dielectrics for transformers, capacitors, reclosers, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB) mineral oil or less-flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall not be used. Liquid dielectrics in retrofitted equipment shall be certified by the manufacturer as having less than 50 parts per million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 923 and have tests performed per ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 50 ppm shall be replaced.

2.17 FACTORY TESTS

Factory tests shall be performed, as follows, in accordance with the applicable publications and with other requirements of these specifications. The Contracting Officer shall be notified at least 10 days before the equipment is ready for testing. The Contracting Officer reserves the right to witness the tests.

a. Transformers: Manufacturer's standard routine tests in accordance with IEEE C57.12.00.

b. Transformers rated 200 kVA and above: Reduced full-wave, chopped-wave, and full-wave impulse test on each line and neutral terminal, in accordance with IEEE C57.98.

c. Instrument Current Transformers: Manufacturer’s standard tests in accordance with IEEE C57.13.

d. Factory Preformed Terminations: Wet withstand voltage tests in accordance with IEEE Std 48 for the next higher BIL level.

e. Outdoor Switchgear: Manufacturer's standard tests in accordance with IEEE C37.20.1, IEEE C37.20.2, and IEEE C37.20.3.

2.18 FENCING

Fencing shall conform to the requirements of Section 02831 CHAIN LINK FENCE.

2.19 COORDINATED POWER SYSTEM PROTECTION

Analyses shall be prepared to demonstrate that the equipment selected and system constructed meet the contract requirements for equipment ratings, coordination, and protection. They shall include a load flow analysis, a fault current analysis, and a protective device coordination study. The studies shall be performed by a registered professional engineer with demonstrated experience in power system coordination in the last three years. The Contractor shall provide a list of references complete with points of contact, addresses and telephone numbers. The selection of the engineer is subject to the approval of the Contracting Officer.

2.19.1 Scope of Analyses

The fault current analysis, and protective device coordination study shall begin at: the source bus and extend down to system bused where fault availability is 10,000 amperes (symmetrical) for building/facility 600 volt level distribution buses.

2.19.2 Determination of Facts

The time-current characteristics, features, and nameplate data for each existing protective device shall be determined and documented. The Contractor shall coordinate with the PWBC (post utility) for fault current availability at the site.

2.19.3 Single Line Diagram

A single line diagram shall be prepared to show the electrical system buses, devices, transformation points, and all sources of fault current (including generator and motor contributions). A fault-impedance diagram or a computer analysis diagram may be provided. Each bus, device or transformation point shall have a unique identifier. If a fault-impedance diagram is provided, impedance data shall be shown. Locations of switches, breakers, and circuit interrupting devices shall be shown on the diagram together with available fault data, and the device interrupting rating.

2.19.4 Fault Current Analysis

2.19.4.1 Method

The fault current analysis shall be performed in accordance with methods described in IEEE Std 242, and IEEE Std 399.

2.19.4.2 Data

Actual data shall be utilized in fault calculations. Bus characteristics and transformer impedances shall be those proposed. Data shall be document in the report.

2.19.5 Coordinated Study

The study shall demonstrate that the maximum possible degree of selectively has been obtained between devices specified, consistent with protection of equipment and conductors from damage from overloads and fault

conditions. The study shall include a description of the coordination of the protective devices in this project. Provide a written narrative that describes: which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; situations where system coordination is not achievable due to device limitations (an analysis of any device curves which overlap); coordination between upstream and downstream devices; and any relay settings. Recommendations to improve or enhance system reliability, and detail where such changes would involve additions or modifications to the contract and cost changes (addition or reduction) shall be provided. Composite coordination plots shall be provided on the log-log graph paper.

2.19.6 Study Report

a. The report shall include a narrative describing: the analyses performed; the bases and methods used; and the desired method of coordinated protection of the power system.

b. The study shall include descriptive and technical data for existing devices and new protective devices proposed. The data shall include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices.

c. The report shall document utility company data including system voltages, fault MVA, system X/R ratio, time-current characteristics curves, current transformer ratios, and relay device numbers and settings;

d. The report shall contain fully coordinated composite time-current characteristic curves for each bus in the system, as required to ensure coordinated power system protection between protective devices or equipment. The report shall include recommended ratings and settings of all protective devices in tabulated form.

e. The report shall provide the calculation performed for the analyses, including computer analysis programs utilized. The name of the software package, developer, and version number shall be provided.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Circuits installed aerially shall conform to the requirements of Section 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Concrete work shall have minimum 20 Mpa compressive strength and conform to the requirements of Section 03300CAST-IN-PLACE STRUCTURAL CONCRETE.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

3.1.3 Disposal of Liquid Dielectrics

PCB-contaminated dielectrics must be marked as PCB and transported to and incinerated by an approved EPA waste disposal facility. The Contractor shall furnish certification of proper disposal. Contaminated dielectrics shall not be diluted to lower the contamination level.

3.2 CABLE AND BUSWAY INSTALLATION

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, etc. The Contractor shall then perform pulling calculations and prepare a pulling plan which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS.

3.2.1 Cable Installation Plan and Procedure

Cable shall be installed strictly in accordance with the cable manufacturer's recommendations. Each circuit shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

3.2.1.1 Cable Inspection

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

3.2.1.2 Duct Cleaning

Duct shall be cleaned with an assembly that consists of a flexible mandrel (manufacturers standard product in lengths recommended for the specific size and type of duct) that is 6.4 mm (1/4 inch) less than inside diameter of duct, 2 wire brushes, and a rag. The cleaning assembly shall be pulled through conduit a minimum of 2 times or until less than a volume of 131 cubic centimeters (8 cubic inches) of debris is expelled from the duct.

3.2.1.3 Duct Lubrication

The cable lubricant shall be compatible with the cable jacket for cable that is being installed. Application of lubricant shall be in accordance with lubricant manufacturer's recommendations.

3.2.1.4 Cable Installation

The Contractor shall provide a cable feeding truck and a cable-pulling winch as required. The Contractor shall provide a pulling grip or pulling eye in accordance with cable manufacturer's recommendations. The pulling grip or pulling eye apparatus shall be attached to polypropylene or manilla rope followed by lubricant front end packs and then by power cables. A dynamometer shall be used to monitor pulling tension. Pulling tension shall not exceed cable manufacturer's recommendations. The Contractor shall not allow cables to cross over while cables are being fed into duct. For cable installation in cold weather, cables shall be kept at 10 degrees C (50 degrees F) temperature for at least 24 hours before installation.

3.2.1.5 Cable Installation Plan

The Contractor shall submit a cable installation plan for all cable pulls in accordance with the detail drawings portion of paragraph SUBMITTALS. Cable installation plan shall include:

a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.

b. List of cable installation equipment.

c. Lubricant manufacturer's application instructions.

d. Procedure for resealing cable ends to prevent moisture from entering cable.

e. Cable pulling tension calculations of all cable pulls.

f. Cable percentage conduit fill.

g. Cable sidewall thrust pressure.

h. Cable minimum bend radius and minimum diameter of pulling wheels used.

i. Cable jam ratio.

j. Maximum allowable pulling tension on each different type and size of conductor.

k. Maximum allowable pulling tension on pulling device.

3.2.2 Duct Line

Cables shall be installed in duct lines where indicated. Cable joints in medium-voltage cables shall be made in manholes or approved pullboxes only. Neutral and grounding conductors shall be installed in the same duct with their associated phase conductors.

3.2.3 NOT USED

3.2.4 NOT USED

3.2.5 Electric Manholes

Cables shall be routed around the interior walls and securely supported from walls on cables racks. Cable routing shall minimize cable crossover, provide access space for maintenance and installation of additional cables, and maintain cable separation in accordance with IEEE C2.

3.2.6 Busway Installation

Busways penetrating walls shall have wall flanges installed on both surfaces of walls. Wall openings shall be approximately 6.4 mm larger than the busway on each of the 4 busway sides, and openings shall be sealed with a suitable compound. Fire barriers shall be provided when penetrating fire rated walls. Fire barriers shall have a rating equal to the fire wall rating. A weather barrier shall be used when a busway penetrates an exterior wall. Busways shall be supported at intervals not exceeding 3 m and shall be braced to prevent lateral movement.

3.3 CABLE JOINTS

Medium-voltage cable joints shall be made by qualified cable splicers only. Qualifications of cable splicers shall be submitted in accordance with paragraph SUBMITTALS. Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed joints. Shields shall be grounded at each joint or in accordance with manufacturer's recommended practice. Cable joints shall provide insulation and jacket equivalent to that of the associated cable. Armored cable joints shall be enclosed in compound-filled, cast-iron or alloy, splice boxes equipped with stuffing boxes and armor clamps of a suitable type and size for the cable being installed.

3.4 FIREPROOFING

Each medium-voltage cable and conductor in manholes shall be fireproofed for their entire length within the manhole. Where cables and conductors have been lubricated to enhance pulling into ducts, the lubricant shall be removed from cables and conductors exposed in the manhole before fireproofing.

3.4.1 Tape Method

Before application of fireproofing tape, plastic tape wrapping shall be applied over exposed metallic items such as the cable ground wire, metallic outer covering, or armor to minimize the possibility of corrosion from the fireproofing materials and moisture. Before applying fireproofing tape, irregularities of cables, such as at cable joints, shall be evened out with insulation putty. A flexible conformable polymeric elastomer fireproof tape shall be wrapped tightly around each cable spirally in 1/2 lapped wrapping or in 2 butt-jointed wrappings with the second wrapping covering the joints of the first.

3.4.2 Sprayable Method

Manholes shall be power ventilated until coatings are dry and dewatered and the coatings are cured. Ventilation requirements shall be in accordance with the manufacturer's instruction, but not less than 10 air changes per hour shall be provided. Cable coatings shall be applied by spray, brush, or glove to a wet film thickness that reduces to the dry film thickness approved for fireproofing by FM P7825. Application methods and necessary safety precautions shall be in accordance with the manufacturers instructions. After application, cable coatings shall be dry to the touch in 1 to 2 hours and fully cured in 48 hours, except where the manufacturer has stated that because of unusual humidity or temperature, longer periods may be necessary.

3.5 DUCT LINES

3.5.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 100 mm per 30 m. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 450 mm (18 inches) for ducts of less than 80 mm (3 inch) diameter, and 900 mm (36 inches) for ducts 80 mm (3 inches) or greater in diameter. Otherwise, long sweep bends having a minimum radius of 7.6 m shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in manholes or handholes.

3.5.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.5.3 Concrete Encasement

Ducts requiring concrete encasements shall comply with NFPA 70, except that electrical duct bank configurations for ducts 150 mm (6 inches) in diameter shall be determined by calculation and as shown on the

drawings. The separation between adjacent electric power and communication ducts shall conform to IEEE C2. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. The Contractor shall submit proposed bonding method for approval in accordance with the detail drawing portion of paragraph SUBMITTALS. At any point, except railroad and airfield crossings, tops of concrete encasements shall be not less than the cover requirements listed in NFPA 70. At railroad and airfield crossings, duct lines shall be encased with concrete and reinforced as indicated to withstand specified surface loadings. Tops of concrete encasements shall be not less than 1.5 m below tops of rails or airfield paving unless otherwise indicated. Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 15 m in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 1.2 m on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 150 mm vertically.

3.5.4 Nonencased Direct-Burial

Top of duct lines shall be below the frost line depth of 457 mm, but not less than 610 mm below finished grade and shall be installed with a minimum of 75 mm of earth around each duct, except that between adjacent electric power and communication ducts, 300 mm of earth is required. Bottoms of trenches shall be graded toward manholes or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 75 mm layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least1 50 mm. The first 150 mm layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 75 to 150 mm layers. Duct banks may be held in alignment with earth. However, high-tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

3.5.5 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved.

3.5.5.1 Bituminized-Fiber Ducts

Bituminized-fiber ducts shall be used to interface with existing bituminized-fiber duct as shown. To ensure a watertight joint, tapered ends or joints of the same material as the ducts shall be swabbed with bituminous or joint-sealing compound before couplings are applied. Plastic or nonmetallic couplings shall be tightly driven onto unswabbed ducts. Due to the brittleness of plastic couplings at low temperatures, such couplings shall not be installed when temperatures are below minus 18 degrees C (0 degrees F). Couplings shall be warmed in hot water or by another approved method when installed at temperatures below0 degrees C (32 degrees F).

3.5.5.2 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

3.5.6 Duct Line Markers

Duct line markers shall be provided at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures. In addition to markers, a 0.127 mm (5 mil) brightly colored plastic tape, not less than 75 mm (3 inches) in width and suitably

inscribed at not more than 3 m (10 feet) on centers with a continuous metallic backing and a corrosion-resistant 0.0254 mm (1 mil) metallic foil core to permit easy location of the duct line, shall be placed approximately 300 mm below finished grade levels of such lines.

3.6 MANHOLES, HANDHOLES, AND PULLBOXES

3.6.1 General

Manholes shall be constructed approximately where shown. The exact location of each manhole shall be determined after careful consideration has been given to the location of other utilities, grading, and paving. The location of each manhole shall be approved by the Contracting Officer before construction of the manhole is started. Manholes shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. The Contractor may at his option utilize monolithically constructed precast-concrete manholes having the required strength and inside dimensions as required by the drawings or specifications. In paved areas, frames and covers for manhole and handhole entrances in vehicular traffic areas shall be flush with the finished surface of the paving. In unpaved areas, the top of manhole covers shall be approximately 15 mm above the finished grade. Where existing grades that are higher than finished grades are encountered, concrete assemblies designed for the purpose shall be installed to elevate temporarily the manhole cover to existing grade level. All duct lines entering manholes must be installed on compact soil or otherwise supported when entering a manhole to prevent shear stress on the duct at the point of entrance to the manhole. Duct lines entering cast-in-place concrete manholes shall be cast in-place with the manhole. Duct lines entering precast concrete manholes through a precast knockout penetration shall be grouted tight with a portland cement mortar. PVC duct lines entering precast manholes through a PVC endbell shall be solvent welded to the endbell. A cast metal grille-type sump frame and cover shall be installed over the manhole sump. A cable-pulling iron shall be installed in the wall opposite each duct line entrance.

3.6.2 Electric Manholes

Cables shall be securely supported from walls by hot-dip galvanized cable racks with a plastic coating over the galvanizing and equipped with adjustable hooks and insulators. The number of cable racks indicated shall be installed in each manhole and not less than 2 spare hooks shall be installed on each cable rack. Insulators shall be made of high-glazed porcelain. Insulators will not be required on spare hooks.

3.6.3 Communications Manholes

The number of hot-dip galvanized cable racks with a plastic coating over the galvanizing indicated shall be installed in each telephone manhole. Each cable rack shall be provided with 2 cable hooks. Cables for the telephone and communication systems will be installed by others.

3.6.4 Handholes

Handholes shall be located approximately as shown. Handholes shall be of the type noted on the drawings and shall be constructed in accordance with the details shown.

3.6.5 Pullboxes

Pullbox tops shall be flush with sidewalks or curbs or placed 15 mm above surrounding grades when remote from curbed roadways or sidewalks. Covers shall be marked "Low-Voltage" and provided with 2 lifting eyes and 2 hold-down bolts. Each box shall have a suitable opening for a ground rod. Conduit, cable, ground rod entrances, and unused openings shall be sealed with mortar.

3.6.6 Ground Rods

A ground rod shall be installed at the manholes, handholes and pullboxes. Ground rods shall be driven into the earth before the manhole floor is poured so that approximately 100 mm of the ground rod will extend above the manhole floor. When precast concrete manholes are used, the top of the ground rod may be below the manhole floor and a No. 1/0 AWG ground conductor brought into the manhole through a watertight sleeve in the manhole wall.

3.7 PAD-MOUNTED EQUIPMENT INSTALLATION

Pad-mounted equipment, shall be installed on concrete pads in accordance with the manufacturer's published, standard installation drawings and procedures, except that they shall be modified to meet the requirements of this document. Units shall be installed so that they do not damage equipment or scratch painted or coated surfaces. After installation, surfaces shall be inspected and scratches touched up with a paint or coating provided by the manufacturer especially for this purpose.

3.7.1 Concrete Pads

3.7.1.1 Construction

Concrete pads for pad-mounted electrical equipment shall be poured-in-place. Pads shall be constructed as indicated, except that exact pad dimensions and mounting details are equipment specific and are the responsibility of the Contractor. Tops of concrete pads shall be level and shall project 100 mm above finished paving or grade and sloped to drain. Edges of concrete pads shall have 20 mm chamfer. Conduits for primary, secondary, and grounding conductors shall be set in place prior to placement of concrete pads. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. To facilitate cable installation and termination, the concrete pad shall be provided with a rectangular hole below the primary and secondary compartments, sized in accordance with the manufacturer's recommended dimensions. Upon completion of equipment installation the rectangular hole shall be filled with masonry grout.

3.7.1.2 Concrete and Reinforcement

Concrete work shall have minimum 20 Mpa compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete pad reinforcement shall be in accordance with Section 03200 CONCRETE REINFORCEMENT.

3.7.1.3 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.7.2 Padlocks

Padlocks shall be provided for pad-mounted equipment and for each fence gate. Padlocks shall be keyed as directed by the Contracting Officer.

3.7.3 NOT USED

3.8 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

Connections between aerial and underground systems shall be made as shown. Underground cables shall be extended up poles in conduit to cable terminations. Conduits shall be secured to the poles by 2-hole galvanized steel pipe straps spaced not more than 3 m apart and with 1 strap not more than 300 mm from any bend or termination. Cable guards shall be secured to poles in accordance with the manufacturer's published

procedures. Conduits shall be equipped with bushings to protect cables and minimize water entry. Capnut potheads shall be used to terminate medium-voltage multiple-conductor cable. Cables shall be supported by devices separate from the conduit or guard, near their point of exit from the conduit or guard.

3.8.1 Pole Installation

Joint-use electric/roadway-lighting poles for overhead electric wood poles utilizing crossarm construction. Crossarm construction shall be provided for support of other equipment, except where direct-pole mounting is indicated. A vertical pole space of not less than 600 mm.

3.8.1.1 Wood Pole Setting

Wood Pole Setting: Wood poles shall be set straight and firm. In normal firm ground, minimum pole-setting depths shall be as listed in Table II. In rocky or swampy ground, pole-setting depths shall be decreased or increased respectively in accordance with the local utility's published standards and as approved. In swampy or soft ground, a bog shoe shall be used where support for a pole is required. Poles in straight runs shall be in a straight line. Curved poles shall be placed with curvatures in the direction of the pole line. Poles shall be set to maintain as even a grade as practicable. If it becomes necessary to shorten a pole, a piece shall be sawed off the top end and roofed. If any pole is shortened after treatment, the shortened end of the pole shall be given an application of hot preservative. Where poles are set on hilly terrain, along edges of cuts or embankments, or where soil may be washed out, special precautions shall be taken to ensure durable pole foundations, and the setting depth shall be measured from the lower side of the pole. Holes shall be dug large enough to permit proper use of tampers to the full depth of a hole. Earth shall be placed into the hole in 300 mm maximum layers, then thoroughly tamped before the next layer is placed. Surplus earth shall be placed around each pole in a conical shape and packed tightly to drain water away from poles.

TABLE II

MINIMUM POLE-SETTING DEPTH (METERS)

Length Overall Meters	Straight Lines	Curves, Corners, and Points of Extra Strain
6.1	1.5	1.5
7.6	1.7	1.7
9.2	1.7	1.7
10.7	1.8	1.8
12.2	1.8	1.8
13.7	2.0	2.1
15.2	2.1	2.3
16.7	2.3	2.5
18.3	2.5	2.6
19.8	2.6	2.6
21.3	2.8	2.9
22.9	2.9	3.0
24.4	3.0	3.2
25.9	3.2	3.3
27.4	3.3	3.5
28.9	3.5	3.7
30.5	3.7	3.8

3.8.2 CROSSARM MOUNTING

Crossarms shall be bolted to poles with 15.9 mm through-bolts with square washers at each end. Bolts shall extend not less than 3 mm nor more than 50 mm beyond nuts. On single crossarm construction, the bolt head shall be installed on the crossarm side of the pole. Wood crossarm braces shall be provided on crossarms. Flat braces may be provided for 2.4 m crossarms and shall be 6.4 by 31.8 mm not less than 700 mm in length. Flat braces shall be bolted to arms with 9.5 mm carriage bolts with round or square washers between boltheads and crossarms, and secured to poles with 50.8 by 101.6 mm lag screws after crossarms are leveled and aligned. Angle braces are required for 3.1 m crossarms and shall be 1.5 m span by 457.2 mm drop formed in one piece from 38.1 by 38.1 by 4.8 angle. Angle braces shall be bolted to crossarms with 50.8 mm bolts with round or square washers between boltheads and crossarms, and secured to poles with 15.9 mm through-bolts. Double crossarms shall be securely held in position by means of 15.9 mm double-arming bolts. Each double-arming bolt shall be equipped with four nuts and four square washers.

3.8.2.1 Line Arms and Buck Arms

Line arms and buck arms shall be set at right angles to lines for straight runs and for angles 45 degrees and greater; and line arms shall bisect angles of turns of less than 45 degrees. Dead-end assemblies shall be used for turns where shown. Buckarms shall be installed, as shown, at corners and junction poles. Double crossarms shall be provided at ends of joint use or conflict sections, at dead-ends, and at angles and corners to provide adequate vertical and longitudinal strength. Double crossarms shall be provided at each line-crossing structure and where lines not attached to the same pole cross each other.

3.8.2.2 Equipment Arms

Equipment arms shall be set parallel or at right angles to lines as required to provide climbing space. Equipment arms shall be located below line construction to provide necessary wire and equipment clearances.

3.8.3 GUY INSTALLATION

Guys shall be provided where shown, with loads and strengths as indicated, and wherever conductor tensions are not balanced, such as at angles, corners, and dead-ends. Where a single guy will not provide the required strength, two or more guys shall be provided. Where guys are wrapped around poles, at least two guy hooks shall be provided and pole shims shall be provided where guy tension exceeds 27 kN. Guy clamps 152.4 mm in length with three 15.9 mm bolts, or offset-type guy clamps, or approved guy grips shall be provided at each guy terminal. Guy-strain insulators shall be provided in each guy for wood poles. Multiple-helix screw anchors shall be provided in marshy ground; rock anchors shall be installed in rock at right angles to guys, elsewhere anchors shall be of an expanding type, except that power installed screw anchors of equivalent holding power are acceptable. A half-round gray polyvinyl, fiberglass, or other suitable plastic guy marker, not less than 2.4 m in length, shall be provided at the anchor end of each guy shown, securely clamped to the guy or anchor at the bottom and top of the marker. Holding capacities for down guys shall be based on a lead angle of 45 degrees.

3.9 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated, and shall be connected to the first applicable termination point in each building. Interfacing with building interior conduit systems shall be at conduit stubouts terminating 1.5 m outside of a building and 600 mm below finished grade as specified and provided under Section 16415 ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed with caulking compound to prevent entrance of moisture or gases into buildings.

3.10 GROUNDING

A ground consisting of the indicated configuration of bare copper conductors and driven ground rods shall be installed around pad-mounted equipment as shown. Equipment frames of metal-enclosed equipment, and other

noncurrent-carrying metal parts, such as cable shields, cable sheaths and armor, and metallic conduit shall be grounded. At least 2 connections shall be provided from a transformer, to the ground. Metallic frames and covers of handholes and pull boxes shall be grounded by use of a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.10.1 Grounding Electrodes

Grounding electrodes shall be installed as shown on the drawings and as follows:

a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately 300 mm below finished grade.

b. Additional electrodes - When the required ground resistance is not met, additional electrodes shall be provided interconnected with grounding conductors to achieve the specified ground resistance. The additional electrodes will be a single extension-type rod, 19.1 mm (3/4 inch) diameter, up to 9.1 m (30 feet) long, driven perpendicular to grade and coupled and driven with the first rod. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

3.10.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

3.10.3 Grounding and Bonding Conductors

Grounding and bonding conductors include conductors used to bond transformer enclosures and equipment frames to the grounding electrode system. Grounding and bonding conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

3.10.4 Surge Arrester Grounding

Surge arresters and neutrals shall be bonded directly to the transformer enclosure and then to the grounding electrode system with a bare copper conductor, sized as shown. Lead lengths shall be kept as short as practicable with no kinks or sharp bends.

3.10.5 Manhole, Handhole, or Concrete Pullbox Grounding

Ground rods installed in manholes, handholes, or concrete pullboxes shall be connected to cable racks, cable-pulling irons, the cable shielding, metallic sheath, and armor at each cable joint or splice by means of a No. 4 AWG braided tinned copper wire. Connections to metallic cable sheaths shall be by means of tinned terminals soldered to ground wires and to cable sheaths. Care shall be taken in soldering not to damage metallic cable sheaths or shields. Ground rods shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 50 mm above and 150 mm below concrete penetrations. Grounding electrode conductors shall be neatly and firmly attached to manhole or handhole walls and the amount of exposed bare wire shall be held to a minimum.

3.10.6 Metal Splice Case Grounding

Metal splice cases for medium-voltage direct-burial cable shall be grounded by connection to a driven ground rod located within 600 mm of each splice box using a grounding electrode conductor having a current-carrying capacity of at least 20 percent of the individual phase conductors in the associated splice box, but not less than No. 6 AWG.

3.10.7 NOT USED

3.11 FIELD TESTING

3.11.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 15 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field test reports shall be signed and dated by the Contractor.

3.11.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.11.3 Ground-Resistance Tests

The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

a. Single rod electrode - 25 ohms.

b. Multiple rod electrodes - 25 ohms.

3.11.4 NOT USED

3.11.5 Medium-Voltage Cable Test

After installation and before the operating test or connection to an existing system, the medium-voltage cable system shall be given a high potential test. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors as one terminal and connecting grounds or metallic shieldings or sheaths of the cable as the other terminal for each test. Prior to making the test, the cables shall be isolated by opening applicable protective devices and disconnecting equipment. The test shall be conducted with all splices, connectors, and terminations in place. The method, voltage, length of time, and other characteristics of the test for initial installation shall be in accordance with NEMA WC 7 or NEMA WC 8 for the particular type of cable installed, except that 28 kV and 35 kV insulation test voltages shall be in accordance with either AEIC CS5 or AEIC CS6 as applicable, and shall not exceed the recommendations of IEEE Std 404 for cable joints and IEEE Std 48 for cable terminations unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing. Should any cable fail due to a weakness of conductor insulation or due to defects or

injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed. Repaired or replaced cables shall be retested.

3.11.6 Low-Voltage Cable Test

Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

R in megohms = (rated voltage in kV + 1) x 304,800/(length of cable in meters)

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

3.11.7 Liquid-Filled Transformer Tests

The following field tests shall be performed on all liquid-filled transformers. Pass-fail criteria shall be in accordance with transformer manufacturer's specifications.

a. Insulation resistance test phase-to-ground.

b. Turns ratio test.

c. Correct phase sequence.

3.11.8 thru 3.11.11 NOT USED

3.11.12 Pre-Energization Services

Calibration, testing, adjustment, and placing into service of the installation shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of 2 years of current product experience. The following services shall be performed on the equipment listed below. These services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to ensure that installation is in compliance with the recommendations of the manufacturer and as shown on the detail drawings. Terminations of conductors at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage during installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage caused during installation or shipment to ensure packaging materials have been removed. Components capable of being both manually and electrically operated shall be operated manually prior to the first electrical operation. Components capable of being calibrated, adjusted, and tested shall be calibrated, adjusted, and tested in accordance with the instructions of the equipment manufacturer. Items for which such services shall be provided, but are not limited to, are the following:

a. Pad-mounted transformers

b. Switches

3.11.13 Operating Tests

After the installation is completed, and at such times as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the requirements herein. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

3.12 MANUFACTURER'S FIELD SERVICE

3.12.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, and servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations.

3.12.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of the equipment, assist in the performance of the onsite tests, initial operation, and instruct personnel as to the operational and maintenance features of the equipment.

3.13 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION DISCOM Barracks Complex Phase 1, Fort Campbell, KY				CONTRACTOR									SPEC. SECTION 16375	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-01 Data										
		1	Fault Current and Protective Devices Coordination Studies; GA.										
		2	Manufacturer's Catalog Data; FIO.										
		3	Material, Equipment, and Fixture Lists; FIO.										
		4	Installation Procedures; FIO.										
			SD-04 Drawings										
		5	Electrical Distribution System; GA.										
		6	As-Built Drawings; FIO.										
			SD-09 Reports										
		7	Factory Test; FIO.										
		8	Field Testing; GA.										
		9	Test Reports; GA.										
		10	Cable Installation Reports; GA.										
			SD-13 Certificates										
		11	Materials and Equipment; FIO.										
		12	Cable Splicer Qualification; FIO.										
		13	Cable Installer Qualifications; FIO.										
			SD-19 Operation and Maintenance Manuals										
		14	Electrical Distribution System; GA.										

***** SAFETY PAYS *****

SECTION 16415

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SECTION 16415

ELECTRICAL WORK, INTERIOR

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(1995) Code for Electricity Metering
ANSI C12.11	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL Through 350 kV BIL (0.6 kV NSV Through 69 kV NSV)
ANSI C39.1	(1981; R 1992) Requirements for Electrical Analog Indicating Instruments
ANSI C57.12.10	(1987) Safety Requirements for Transformers 230 kV and Below 833/958 Through 8333/10417 kVA, Single-Phase, and 750/862 Through 60 000/80 000/100 000 kVA, Three-Phase Without Load Tap Charging; and 3750/4687 Through 60 000/80 000/100 000 kVA With Load Tap Charging
ANSI C57.12.50	(1981; R 1989) Ventilated Dry-type Distribution Transformers 1 to 500 kVA, Single-Phase; and 15 to 500 kVA, Three-Phase with High-Voltage 601 to 34 500 Volts, Low-Voltage 120 to 600 Volts
ANSI C57.12.70	(1978; R 1993) Terminal Markings and Connections for Distribution and Power Transformers
ANSI C82.1	(1985; C82.1a; C82.1b; C82.1c; R 1992) Specifications for Fluorescent Lamp Ballasts
ANSI C82.4	(1992) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 1	(1990) Hard-Drawn Copper Wire
ASTM D 709	(1992) Laminated Thermosetting Materials

CODE OF FEDERAL REGULATIONS (CFR)

47 CFR 18	Industrial, Scientific, and Medical Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
IEEE C57.12.80	(1978; R 1992) Terminology for Power and Distribution Transformers
IEEE C57.12.90	(1993) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers
IEEE ANSI/IEEE C57.13	(1993) Instrument Transformers
IEEE C57.98	(1993) Guide for Transformer Impulse Tests
IEEE C62.41	(1991) Surge Voltages in Low-Voltage AC Power Circuits
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 242	(1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE Std 399	(1990) Recommended Practice for Industrial and Commercial Power Systems Analysis

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches
NEMA FU 1	(1986) Low Voltage Cartridge Fuses
NEMA ICS 1	(1993) Industrial Control and Systems
NEMA ICS 2	(1993) Industrial Control and Systems Controllers, Contactors, Overload Relays Rated Not More Than 2,000 Volts AC or 750 DC
NEMA ICS 3	(1993) Industrial Control and Systems Factory Built Assemblies
NEMA ICS 6	(1993) Industrial Control and Systems Enclosures
NEMA LE 4	(1987) Recessed Luminaires, Ceiling Compatibility
NEMA MG 1	(1993; Rev 1; Rev 2; Rev 3) Motors and Generators
NEMA MG 10	(1994) Energy Management Guide for Selection and Use of Polyphase Motors

NEMA OS 1	(1989) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA OS 2	(1986; Errata Aug 1986; R 1991) Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
NEMA PB 1	(1990) Panelboards
NEMA PB 2	(1995) Deadfront Distribution Switchboards
NEMA RN 1	(1989) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA ST 20	(1992) Dry-Type Transformers for General Applications
NEMA TC 2	(1990) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA VE 1	(1991) Metal Cable Tray Systems
NEMA WD 1	(1983; R 1989) General Requirements for Wiring Devices
NEMA WD 6	(1988) Wiring Devices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996) National Electrical Code
NFPA 101	(1997) Safety to Life from Fire in Buildings and Structures

UNDERWRITERS LABORATORIES (UL)

UL-03	(1996; Supple) Electrical Construction Materials Directory
UL 1	(1993; Rev thru Jan 1995) Flexible Metal Conduit
UL 5	(1995) Surface Metal Raceways and Fittings
UL 6	(1993; Rev Mar 1996) Rigid Metal Conduit
UL 20	(1995; Rev thru Apr 1997) General-Use Snap Switches
UL 44	(1997) Thermoset-Insulated Wires and Cables
UL 50	(1995; Rev Oct 1996) Enclosures for Electrical Equipment
UL 67	(1993; Rev thru Dec 1993) Panelboards
UL 83	(1996) Thermoplastic-Insulated Wires and Cables

UL 98	(1994; R Oct 1995) Enclosed and Dead-Front Switches
UL 198B	(1995) Class H Fuses
UL 198C	(1986; Rev thru Jun 1993) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198D	(1995) Class K Fuses
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 198H	(1988; Rev thru Nov 1993) Class T Fuses
UL 360	(1996; Rev Mar 1997) Liquid-Tight Flexible Steel Conduit
UL 467	(1993; Rev thru Aug 1996) Grounding and Bonding Equipment
UL 486A	(1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997) Wire Connectors for Use with Aluminum Conductors
UL 486C	(1997) Splicing Wire Connectors
UL 486E	(1994; Rev thru Feb 1997) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
UL 489	(1996; Rev May 1997) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	(1996) Attachment Plugs and Receptacles
UL 506	(1994; Rev Jul 1994) Specialty Transformers
UL 508	(1993) Industrial Control Equipment
UL 510	(1994) Insulating Tape
UL 512	(1993; R Dec 1995) Fuseholders
UL 514A	(1996) Metallic Outlet Boxes
UL 514B	(1996) Fittings for Conduit and Outlet Boxes
UL 514C	(1996) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 542	(1994; Rev May 1997) Lampholders, Starters, and Starter Holders for Fluorescent Lamps
UL 651	(1995; Rev Jan 1997) Schedule 40 and 80 Rigid PVC Conduit

UL 651A	(1995; Rev Sep 1996) Type EB and A Rigid PVC Conduit and HDPE Conduit
UL 674	(1994; Rev thru Feb 1997) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
UL 719	(1996) Nonmetallic-Sheathed Cables
UL 797	(1993; Rev thru Mar 1997) Electrical Metallic Tubing
UL 817	(1994; Rev thru Feb 1997) Cord Sets and Power-Supply Cords
UL 869A	(1993; Rev Apr 1994) Reference Standard for Service Equipment
UL 891	(1994; Rev thru Jan 1995) Dead-Front Switchboards
UL 924	(1995; Rev thru May 95) Emergency Lighting and Power Equipment
UL 935	(1995; Rev thru Apr 1997)Fluorescent-Lamp Ballasts
UL 943	(1993; Rev thru Mar 1997)Ground-Fault Circuit Interrupters
UL 1004	(1994; Rev thru Feb 1997) Electric Motors
UL 1029	(1994; Rev Sep 1995) High-Intensity-Discharge Lamp Ballasts
UL 1242	(1996) Intermediate Metal Conduit
UL 1570	(1995) Fluorescent Lighting Fixtures
UL 1571	(1991; Rev thru Mar 95) Incandescent Lighting Fixtures
UL 1572	(1995; Rev thru Sep 96) High Intensity Discharge Lighting Fixtures
UL 1660	(1994) Liquid-Tight Flexible Nonmetallic Conduit

1.2 GENERAL

1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated herein or shown.

1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in

the field so that the outlets and equipment shall be properly located and readily accessible. Lighting fixtures, outlets, and other equipment and materials shall be located to avoid interference with mechanical or structural features; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change. The Contractor shall coordinate electrical work with the HVAC and electrical drawings and specifications and provide power related wiring.

1.2.3 Special Environments

1.2.3.1 Weatherproof Locations

Wiring, Fixtures, and equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

1.2.3.2 NOT USED
1.2.3.3 NOT USED

1.2.4 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.5 NAMEPLATES

1.2.5.1 Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, identification nameplates shall be made of laminated plastic in accordance with ASTM D 709 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The front of each panelboard, motor control center, switchgear, and switchboard shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 6.4 mm High Letters	Minimum 3.2 mm High Letters
Panelboards	Control Power Transformers
Starters	Control Devices
Safety Switches	Instrument Transformers
Transformers	
Equipment Enclosures	
Switchboards	

Motors

Each panel, section, or unit in motor control centers, switchgear or similar assemblies shall be provided with a nameplate in addition to nameplates listed above, which shall be provided for individual compartments in the respective assembly, including nameplates which identify "future," "spare," and "dedicated" or "equipped spaces."

1.2.5.2 NOT USED

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Fault Current and Protective Device Coordination Study; GA

The study shall be submitted along with protective device equipment submittals. No time extensions or similar contract modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed shall be based on recommendations of this study, The Government shall not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

Manufacturer's Catalog; GA.

Data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists; FIO.

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each item.

SD-04 Drawings

Interior Electrical Equipment; GA.

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams, and other information necessary to define the installation. Detail drawings shall show the rating of items and systems and how the components of an item and system are assembled, function together, and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall show physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size,

electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned.

Structural drawings showing the structural or physical features of major equipment items, components, assemblies, and structures, including foundations or other types of supports for equipment and conductors. These drawings shall include accurately scaled or dimensioned outline and arrangement or layout drawings to show the physical size of equipment and components and the relative arrangement and physical connection of related components. Weights of equipment, components and assemblies shall be provided when required to verify the adequacy of design and proposed construction of foundations or other types of supports. Dynamic forces shall be stated for switching devices when such forces must be considered in the design of support structures. The appropriate detail drawings shall show the provisions for leveling, anchoring, and connecting all items during installation, and shall include any recommendations made by the manufacturer.

Electrical drawings including single-line and three-line diagrams, and schematics or elementary diagrams of each electrical system; internal wiring and field connection diagrams of each electrical device when published by the manufacturer; wiring diagrams of cabinets, panels, units, or separate mountings; interconnection diagrams that show the wiring between separate components of assemblies; field connection diagrams that show the termination of wiring routed between separate items of equipment; internal wiring diagrams of equipment showing wiring as actually provided for this project. Field wiring connections shall be clearly identified.
If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures, including changes in related portions of the project and the reasons why, shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Government.

SD-08 Statements

On-Site Test; GA.

A detailed description of the Contractor's proposed procedures for on-site tests.

SD-09 Reports

Factory Test Reports; GA.

Six copies of the information described below in 216 x 280 mmbinders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The conditions specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

Field Test Plan; GA.

A detailed description of the Contractor's proposed procedures for on-site test submitted 20 days prior to testing the installed system. No field test will be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Field Test Reports; GA.

Six copies of the information described below in 216 x 280 mmbinders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The conditions specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

h. Final position of controls and device settings.

SD-13 Certificates

Materials and Equipment; GA.

The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer. Items which are required to be listed and labeled in accordance with Underwriters Laboratories must be affixed with a UL label that states that it is UL listed. No exceptions or waivers will be granted to this requirement. Materials and equipment will be approved based on the manufacturer's published data.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with NFPA 70, recommendations of the manufacturer, and as shown.

PART 2 PRODUCTS

Products shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.1 NOT USED

2.2 CABLES AND WIRES

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.2.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to meet manufacturer's requirements.

2.2.2 Aluminum Conductors

Aluminum conductors shall not be used.

2.2.3 Insulation

Unless indicated otherwise, or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN, THHN, or THW conforming to UL 83 or RHW conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW, THW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.2.4 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.2.5 Service Entrance Cables

Service entrance (SE) and underground service entrance (USE) cables, UL 854.

2.2.6 thru 2.2.11 NOT USED

2.2.12 Cord Sets and Power-Supply Cords

UL 817.

2.3 CABLE TRAYS

NEMA VE 1 cable trays shall form a wireway system, and shall be of nominal 150 mm depth. Cable trays shall be constructed of aluminum. Trays shall include splice and end plates, dropouts, and miscellaneous hardware. Edges, fittings, and hardware shall be finished free from burrs and sharp edges. Fittings shall have not less than the load-carrying ability of straight tray sections and shall have manufacturer's minimum standard radius. Radius of bends shall be 305 mm.

2.3.1 NOT USED

2.3.2 Ladder

Ladder-type cable trays shall be of nominal 450 mmwidth. Rung spacing shall be on 450 mmmaximum centers.

2.3.3 thru 2.2.5 NOT USED

2.6 CIRCUIT BREAKERS

2.6.1 MOLDED-CASE CIRCUIT BREAKERS

Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489. Circuit breakers may be installed in panelboards, switchboards, enclosures, motor control centers, or combination motor controllers.

2.6.1.1 Construction

Circuit breakers shall be suitable for mounting and operating in any position. Lug shall be listed for copper conductors only in accordance with UL 486E. Single-pole circuit breakers shall be full module size with not more than one pole per module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multi-pole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible.

2.6.1.2 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the panelboards and switchboards. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with NEMA AB 1. Ratings shall be coordinated with system X/R ratio.

2.6.1.3 NOT USED

2.6.1.4 NOT USED

2.6.2 Solid-State Trip Elements

Solid-state circuit breakers shall be provided as shown. All electronics shall be self-contained and require no external relaying, power supply, or accessories. Printed circuit cards shall be treated to resist moisture absorption, fungus growth, and signal leakage. All electronics shall be housed in an enclosure which provides protection against arcs, magnetic interference, dust, and other contaminants. Solid-state sensing shall measure true RMS current with error less than one percent on systems with distortions through the 13th harmonic. Peak or average actuating devices are not acceptable. Current sensors shall be torodial construction, encased in a plastic housing filled with epoxy to protect against

damage and moisture and shall be integrally mounted on the breaker. Where indicated on the drawings, circuit breaker frames shall be rated for 100 percent continuous duty. Circuit breakers shall have tripping features as shown on the drawings and as described below:

a. Long-time current pick-up, adjustable from 50 percent to 100 percent of continuous current rating.

b. Fixed long-time delay.

c. Short-time current pick-up, adjustable from 1.5 to 9 times long-time current setting.

d. Fixed short-time delay.

e. Instantaneous current pick-up, adjustable from 1.5 to 9 times long-time current setting.

f. Ground-fault pick-up, adjustable from 20 percent to 60 percent of sensor rating, but in no case greater than 1200 amperes. Sensing of ground-fault current at the main bonding jumper or ground strap shall not be permitted.

g. Fixed ground-fault delay.

2.6.3 NOT USED

2.6.4 SWD Circuit Breakers

Circuit breakers rated 15 amperes and intended to switch 277 volts or less fluorescent lighting loads shall be marked "SWD."

2.6.5 HACR Circuit Breakers

Circuit breakers 60 amperes or below, 240 volts, 1-pole or 2-pole, intended to protect multi-motor and combination-load installations involved in heating, air conditioning, and refrigerating equipment shall be marked "Listed HACR Type."

2.6.6 NOT USED

2.6.7 NOT USED

2.6.8 Ground Fault Circuit Interrupters

UL 943. Breakers equipped with ground fault circuit interrupters shall have ground fault class, interrupting capacity, and voltage and current ratings as indicated.

2.7 NOT USED

2.8 CONDUIT AND TUBING

2.8.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797

2.8.2 NOT USED

2.8.3 NOT USED

2.8.4 Flexible Conduit, Steel and Plastic

General-purpose type, UL 1; liquid tight, UL 360, and UL 1660.

2.8.5 Intermediate Metal Conduit

UL 1242.

2.8.6 PVC Coated Rigid Steel Conduit

NEMA RN 1.

2.8.7 NOT USED

2.8.8 Rigid Metal Conduit

UL 6.

2.8.9 Rigid Plastic

NEMA TC 2, UL 651 and UL 651A.

2.8.10 Surface Metal Electrical Raceways and Fittings

UL 5.

2.9 CONDUIT AND DEVICE BOXES AND FITTINGS

2.9.1 Boxes, Metallic Outlet

NEMA OS 1 and UL 514C.

2.9.2 NOT USED

2.9.3 NOT USED

2.9.4 Boxes, Switch (Enclosed), Surface-Mounted

UL 98.

2.9.5 Fittings for Conduit and Outlet Boxes
UL 514B.

2.9.6 NOT USED

2.9.7 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

UL 514B.

2.10 CONDUIT COATINGS PLASTIC RESIN SYSTEM

NEMA RN 1, Type A-40.

2.11 CONNECTORS, WIRE PRESSURE

2.11.1 For Use With Copper Conductors

UL 486A.

2.11.2 NOT USED

2.12 ELECTRICAL GROUNDING AND BONDING EQUIPMENT

UL 467.

2.12.1 Ground Rods

Ground rods shall be of copper-clad steel conforming to UL 467 not less than 19.1 mmin diameter by 3.1 meterin length of the sectional type driven full length into the earth.

2.12.2 Ground Bus

The ground bus shall be bare conductor or flat copper in one piece, if practicable.

2.13 ENCLOSURES

NEMA ICS 6 or NEMA 250 unless otherwise specified.

2.13.1 Cabinets and Boxes

Cabinets and boxes with volume greater than 0.0164 cubic metersshall be in accordance with UL 50, hot-dip, zinc-coated, if sheet steel.

2.13.2 Circuit Breaker Enclosures

UL 489.

2.13.3 NOT USED

2.14 FIXTURES, LIGHTING AND FIXTURE ACCESSORIES/COMPONENTS

Standard Drawing 40-06-04 sheets referenced hereinafter and enclosed as an integral part of these specifications, additional fixtures shown on contract drawings, if any. Fixtures, accessories and components, including ballasts, lampholders, lamps, starters and starter holders, shall conform to industry standards specified below.

2.14.1 Fixture, Auxiliary or Emergency

UL 924.

2.14.2 Incandescent Fixture

NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1571.

2.14.3 Fluorescent

a. Fixture: NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1570. Fixtures shall be plainly marked for proper lamp and ballast type to identify lamp diameter, wattage, color and start type. Marking shall be readily visible to service personnel, but not visible from normal viewing angles.

b. Electronic Ballast. Electronic ballasts shall consist of a rectifier, high frequency inverter, and power control and regulation circuitry. The ballasts shall be UL listed, Class P, with a Class A sound rating and shall contain no PCBs. Ballasts shall meet 47 CFR 18 for electromagnetic interference and shall not interfere with the operation of other electrical equipment. Design shall withstand line transients per IEEE C62.41, Category A. Unless otherwise indicated, the minimum number of ballasts shall be used to serve each individual fixture, using one, two, three or four lamp ballasts. A single ballast may be used to serve multiple fixtures if they are continuous mounted, factory manufactured for that installation with an integral wireway, and are identically controlled.

(a) Light output regulation shall be +/- 10%.

(b) Voltage input regulation shall be +/- 10%.

(c) Lamp current crest factor shall be no more than 1.6.

(d) Ballast factor shall be not less than 85% nor more than 100%, unless otherwise indicated.

(e) A 60 Hz filter shall be provided. Flicker shall be no more than 10% with any lamp suitable for the ballast.

(f) Ballast case temperature shall not exceed 25 degree Celsius rise above 40 degree Celsius ambient, when tested in accordance with UL 935.

(g) Total harmonic distortion shall be in the range of 10-20%.

(h) Power factor shall not be less than 0.95.

(i) Ballasts shall operate at a frequency of 20 kHz or more.

(j) Operating filament voltage shall be 2.5 to 4.5 volts.

(k) Warranty. Three year full warranty including a $10 labor allowance.

(l) Ballast Efficacy Factor (BEF) shall be in accordance with the following table. Ballasts and lamps shall be matching rapid start or instant start as indicated on the following table. If 32W-F32-T8 lamps and ballasts are used, they must be either all rapid start or all instant start.

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS*

LAMP TYPE	TYPE OF STARTER & LAMP	NOMINAL OPERATIONAL INPUT VOLTAGE	NUMBER OF LAMPS	MIN. BALLAST EFFICACY FACTOR
32W F32 T8	rapid or instant start	120 or 277 V	1	2.4
			2	1.4
			3	1.0
			4	0.8

*For ballasts not specifically designed for use with dimming controls

The BEF is calculated using the formula:

BEF = Ballast Factor (in percent) / Power Input

Where Power Input = Total Wattage of Combined Lamps and Ballasts.

c. Lampholders, Starters, and Starter Holders: UL 542.

2.14.4 High-Intensity-Discharge

a. Fixture: NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1572.

b. Ballasts: ANSI C82.4 for multiple supply types and UL 1029.

2.15 LOW-VOLTAGE FUSES AND FUSEHOLDERS

2.15.1 Fuses, Low Voltage Cartridge Type

NEMA FU 1.

2.15.2 Fuses, High-Interrupting-Capacity, Current-Limiting Type

Fuses, Class G, J, L and CC shall be in accordance with UL 198C.

2.15.3 Fuses, Class K, High-Interrupting-Capacity Type

UL 198D.

2.15.4 Fuses, Class H

UL 198B.

2.15.5 Fuses, Class R

UL 198E.

2.15.6 Fuses, Class T

UL 198H.

2.15.7 Fuses for Supplementary Overcurrent Protection

UL 198G.

2.15.8 NOT USED

2.15.9 Fuseholders

UL 512.

2.16 INSTRUMENTS, ELECTRICAL INDICATING

ANSI C39.1.

2.17 MOTORS, AC, FRACTIONAL AND INTEGRAL

Motors, ac, fractional and integral kilowatt,373.0 kWand smaller shall conform to NEMA MG 1 and UL 1004for motors; NEMA MG 10 for energy management selection of polyphase motors; and UL 674 for use of motors in hazardous (classified) locations.

2.17.1 Rating

The kilowattrating of motors should be limited to no more than 125 percent of the maximum load being served unless a NEMA standard size does not fall within this range. In this case, the next larger NEMA standard motor size should be used.

2.17.2 Motor Efficiencies

All permanently wired polyphase motors of 746 Wor more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 Wor more with open, drip proof or totally enclosed fan cooled enclosures shall be high efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Motor Efficiencies

kW	Std. Efficiency	High Efficiency
0.746	77.0	85.5
1.12	78.5	85.5
1.49	78.5	85.5
2.24	78.5	88.5
3.73	82.5	88.5
5.60	84.0	90.0
7.46	85.5	90.0
11.2	85.5	91.0
14.9	87.5	92.0
18.7	88.5	92.0
22.4	88.5	92.0
29.8	88.5	92.0
37.3	89.0	92.5
44.8	89.0	92.5
56.9	89.0	95.5
74.6	90.0	93.5
93.3	91.0	94.5
112	91.0	94.5
149	91.0	94.5
187	91.0	94.5
224	91.0	94.5
261	91.0	94.5
298	91.0	94.5
373	91.0	94.5

2.18 MOTOR CONTROLS AND MOTOR CONTROL CENTERS

2.18.1 General

NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508 and UL 845. Panelboards supplying non-linear loads shall have neutrals sized for 200 percent of rated current.

2.18.2 Motor Starters

Combination starters shall be provided with as indicated.

2.18.2.1 NOT USED

2.18.3 Thermal-Overload Protection

Each motor of 93 W (1/8 hp)or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating.

2.18.4 NOT USED

2.18.5 Automatic Control Devices

2.18.5.1 Direct Control

Automatic control devices (such as thermostats, float or pressure switches) which control the starting and stopping of motors directly shall be designed for that purpose and have an adequate kilowattrating.

2.18.5.2 Pilot-Relay Control

Where the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit.

2.18.5.3 Manual/Automatic Selection

a. Where combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch (marked MANUAL-OFF-AUTOMATIC) shall be provided for the manual control.

b. Where combination manual and automatic control is specified and the automatic-control device actuates the pilot control circuit of a magnetic starter, the magnetic starter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC.

c. Connections to the selector switch shall be such that; only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low-or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

2.18.6 NOT USED

2.19 PANELBOARDS

Dead-front construction, NEMA PB 1 and UL 67.

2.20 RECEPTACLES

2.20.1 NOT USED

2.20.2 NOT USED

2.20.3 Standard Grade

UL 498.

2.20.4 Ground Fault Interrupters

UL 943, Class A or B.

2.20.5 NOT USED

2.20.6 NEMA Standard Receptacle Configurations
NEMA WD 6.

Single and Duplex, 15-Ampere and 20-Ampere, 125 Volt
15-ampere, non-locking: NEMA type 5-15R, locking: NEMA type L5-15R, 20-ampere, non-locking: NEMA type 5-20R, locking: NEMA type L5-20R.

b. 15-Ampere, 250 Volt

Two-pole, 3-wire grounding, non-locking: NEMA type 6-15R, locking: NEMA type L6-15R. Three-pole, 4-wire grounding, non-locking: NEMA type 15-15R, locking: NEMA type L15-15R.

c. 20-Ampere, 250 Volt

Two-pole, 3-wire grounding, non-locking: NEMA type 6-20R, locking: NEMA type L6-20R. Three-pole, 4-wire grounding, non-locking: NEMA type 15-20R, locking: NEMA type L15-20R.

d. 30-Ampere, 125/250 Volt

Three-pole, 3-wire, non-locking: NEMA type 10-30R, locking: NEMA type L10-30R. Three-pole, 4-wire grounding, non-locking: NEMA type 14-30R, locking: NEMA type L14-30R.

e. 30-Ampere, 250 Volt

Two-pole, 3-wire grounding, non-locking: NEMA type 6-30R, locking: NEMA type L6-30R. Three-pole, 4-wire grounding, non-locking: NEMA type 15-30R, locking: NEMA type L15-30R.

f. 50-Ampere, 125/250 Volt

Three-pole, 3-wire: NEMA type 10-50R. Three-pole, 4-wire grounding: NEMA type 14-50R.

g. 50-Ampere, 250 Volt

Two-pole, 3-wire grounding: NEMA type 6-50R. Three-pole, 4-wire grounding: NEMA type 15-50R.

2.21 SERVICE ENTRANCE EQUIPMENT

UL 869A.

2.22 SPLICE, CONDUCTOR

UL 486C.

2.23 POWER-SWITCHGEAR ASSEMBLIES INCLUDING SWITCHBOARDS

Assemblies shall be metal-enclosed, freestanding general-purpose ventilated type in accordance with NEMA PB 2, UL 891, and IEEE C37.20.1 and shall be installed to provide front and rear access. Busses shall be copper . Assembly shall be approximately 2.3 meters high; arrangement of circuit breakers and other items specified shall be as indicated. The withstand rating and interrupting capacity of the switchboards and circuit breakers shall be based on the maximum fault current available.

2.23.1 Circuit Breakers

Circuit breakers shall be molded-case circuit breakers.

2.23.2 Auxiliary Equipment

2.23.2.1 Instruments

Instruments shall be long scale, 173 mm minimum, semiflush rectangular, indicating or digital switchboard type, mounted at eye level.

a. Ammeter, range 0 to 2500 amperes, complete with selector switch having off position and positions to read each phase current.

b. Voltmeter, range 0 to 600 volts, complete with selector switch having off position and positions to read each phase to phase voltage.

2.23.2.2 Control Switch

A control switch with indicating lights shall be provided for each electrically operated breaker.

2.23.2.3 NOT USED

2.24 SNAP SWITCHES

UL 20.

2.25 TAPES

2.25.1 Plastic Tape

UL 510.

2.25.2 Rubber Tape

UL 510.

2.26 TRANSFORMERS

Single- and three-phase transformers shall have two windings per phase. Full-capacity standard NEMA taps shall be provided in the primary windings of transformers unless otherwise indicated. Three-phase transformers shall be configured with delta-wye windings, except as indicated. "T" connections may be used for transformers rated 15 kVA or below.

2.26.1 Transformers, Dry-Type

Transformers shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation system for transformers rated 10 kVA and less, with temperature rise not exceeding 115 degrees C under full-rated load in maximum ambient temperature of 40 degrees C. Transformer of 115 degrees C temperature rise shall be capable of carrying continuously 115 percent of nameplate kVA without exceeding insulation rating.

a. 600 Volt or Less Primary:

NEMA ST 20, UL 506, general purpose, dry-type, self-cooled, unventilated. Provide transformers in NEMA 1 enclosure. Transformers shall be quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

2.26.2 NOT USED

2.26.3 Average Sound Level

The average sound level in decibels (dB) of transformers shall not exceed the following dB level at 300 mmfor the applicable kVA rating range listed unless otherwise indicated:

kVA Range	dB Sound Level
1-50	50
51-150	55
151-300	58
301-500	60
501-700	62
701-1000	64
1001-1500	65
1501 & above	70

2.27 THRU 2.29 NOT USED

2.30 INSTRUMENT TRANSFORMERS

2.30.1 General

Instrument transformers shall comply with ANSI C12.11 and IEEE ANSI/IEEE C57.13. Instrument transformers shall be configured for mounting in/on the device to which they are applied. Polarity marks on instrument transformers shall be visually evident and shown on drawings.

2.30.2 NOT USED

2.31 WIRING DEVICES

NEMA WD 1 for wiring devices, and NEMA WD 6 for dimensional requirements of wiring devices.

2.32 LIQUID-DIELECTRICS

Liquid dielectrics for transformers, capacitors, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB) mineral oil or less flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall be certified by the manufacturer as having less than 50 parts per million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 50 ppm shall be replaced.

2.33 COORDINATED POWER SYSTEM PROTECTION

Analyses shall be prepared to demonstrate that the equipment and system constructed meet the specified requirements for equipment ratings, coordination, and protection. They shall include a load flow analysis, a fault current analysis, and protective device coordination study. The studies shall be performed by a registered professional engineer with demonstrated experience in power system coordination in the last three years. The Contractor shall provide a list of references complete with points of contact, addresses and telephone numbers. The selection of the engineer is subject to the approval of the Contracting Officer.

2.33.1 Scope of Analyses

The fault current analysis, and protective device coordination study shall begin at the nearest upstream device in the existing source system and extend through the downstream devices at the load end.

2.33.2 Determination of Facts

The time-current characteristics, features, and nameplate data for each existing protective device shall be determined and documented. The Contractor shall coordinate with the Post utility department for fault current availability at the site.

2.33.3 Single Line Diagram

A single line diagram shall be prepared to show the electrical system buses, devices, transformation points, and all sources of fault current (including generator and motor contributions). A fault-impedance diagram or a computer analysis diagram may be provided. Each bus, device or transformation point shall have a unique identifier. If a fault-impedance diagram is provide, impedance data shall be shown. Locations of switches, breakers, and circuit interrupting devices shall be shown on the diagram together with available fault data, and the device interrupting rating.

2.33.4 Fault Current Analysis

2.33.4.1 Method

The fault current analysis shall be performed in accordance with methods described in IEEE Std 242, and IEEE Std 399.

2.33.4.2 Data

Actual data shall be utilized in fault calculations. Bus characteristics and transformer impedances shall be those proposed. Data shall be documented in the report.

2.33.4.3 Fault Current Availability

Balanced three-phase fault, bolted line-to-line fault, and line-to-ground fault current values shall be provided at each voltage transformation point and at each power distribution bus. The maximum and minimum values of fault available at each location shall be shown in tabular form on the diagram or in the report.

2.33.5 Coordination Study

The study shall demonstrate that the maximum possible degree of selectivity has been obtained between devices specified, consistent with protection of equipment and conductors from damage from overloads and fault conditions. The study shall include a description of the coordination of the protective devices in this project. Provide a written narrative that describes: which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; situation where system coordination is not achievable due to device limitations (an analysis of any device curves which order overlap); coordination between upstream and downstream devices; and relay settings. Recommendations to improve or enhance system reliability, and detail where such changes would involve additions or modifications to the contract and cost changes (addition or reduction) shall be provided. Composite coordination plots shall be provided on log-log graph paper.

2.33.6 Study Report

a. The report shall include a narrative: the analyses performed; the bases and methods used; and the desired method of coordinated protection of the power system.

b. The study shall include descriptive and technical data for existing devices and new protective devices proposed. The data shall include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices.

c. The report shall document utility company data including system voltages, fault MVA, system X/R ratio, time-current characteristic curves, current transformer ratios, and relay device curves and protective device ratings and settings.

d. The report shall contain fully coordinated composite time-current characteristic curves for each bus in the system, as required to ensure coordinated power system protection between protective devices or equipment. The report shall include recommended ratings and settings of all protective devices in tabulated form.

e. The report shall provide the calculations performed for the analyses, including computer analysis programs utilized. The name of the software package, developer, and version number shall be provided.

PART 3 EXECUTION

3.1 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following specifications.

3.1.1 Ground Rods

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods not less than 1.8

meterson centers, or if sectional type rods are used, additional sections may be coupled and driven with the first rod. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.1.2 Ground Bus

Ground bus shall be provided in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of electrical equipment shall be effectively grounded by bonding to the ground bus. The ground bus shall be bonded to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 100 mmabove the floor. Connections and splices shall be of the brazed, welded, bolted, or pressure-connector type, except that pressure connectors or bolted connections shall be used for connections to removable equipment. For raised floor equipment rooms in computer and data processing centers, a minimum of 4, one at each corner, multiple grounding systems shall be furnished. Connections shall be bolted type in lieu of thermoweld, so they can be changed as required by additions and/or alterations.

3.1.3 Grounding Conductors

All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per NFPA 70. When boxes for receptacles, switches, or other utilization devices are installed, any designated grounding terminal on these devices shall also be bonded to the equipment grounding conductor junction with a short jumper.

3.2 WIRING METHODS

Wiring shall conform to NFPA 70, the contract drawings, and the following specifications. Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid aluminum conduit, rigid zinc-coated steel conduit, rigid plastic conduit , electrical metallic tubing, electrical nonmetallic tubing , intermediate metal conduit.

3.2.1 Conduit and Tubing Systems

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph WIRING METHODS. Minimum size of raceways shall be 15 mm. Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. Nonmetallic conduit and tubing may be used in damp, wet or corrosive locations when permitted by NFPA 70 and the conduit or tubing system is provided with appropriate boxes, covers, clamps, screws or other appropriate type of fittings. Electrical metallic tubing (EMT) may be installed only within buildings. EMT may be installed in concrete and grout in dry locations. EMT installed in concrete or grout shall be provided with concrete tight fittings. EMT shall not be installed in damp or wet locations, or the air space of exterior masonry cavity walls. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Aluminum conduit may be used only where installed exposed in dry locations. Nonaluminum sleeves shall be used where aluminum conduit passes through concrete floors and firewalls. Penetrations of above grade floor slabs, time-rated partitions and fire walls shall be firestopped in accordance with Section 07270 FIRESTOPPING. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by NFPA 70. Raceways shall not be installed under the firepits of boilers and furnaces and

shall be kept 150 mmaway from parallel runs of flues, steam pipes and hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints or seismic joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding. Wiring installed in underfloor duct system shall be suitable for installation in wet locations.

3.2.1.1 Pull Wires

A pull wire shall be inserted in each empty raceway in which wiring is to be installed if the raceway is more than 15 metersin length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 45 meters in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 1.4 MPa (200 psi) tensile strength. Not less than 254 mm of slack shall be left at each end of the pull wire.

3.2.1.2 Conduit Stub-Ups

Where conduits are to be stubbed up through concrete floors, a short elbow shall be installed below grade to transition from the horizontal run of conduit to a vertical run. A conduit coupling fitting, threaded on the inside shall be installed, to allow terminating the conduit flush with the finished floor. Wiring shall be extended in rigid threaded conduit to equipment, except that where required, flexible conduit may be used 150 mm above the floor. Empty or spare conduit stub-ups shall be plugged flush with the finished floor with a threaded, recessed plug.

3.2.1.3 Below Slab-on-Grade or in the Ground

Electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be rigid steel or IMC. Rigid steel or IMC conduits installed below slab-on-grade or in the earth shall be field wrapped with 0.254 mmthick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

3.2.1.4 Installing in Slabs Including Slabs on Grade

Conduit installed in slabs-on-grade shall be rigid steel or IMC. Conduits shall be installed as close to the middle of concrete slabs as practicable without disturbing the reinforcement. Outside diameter shall not exceed 1/3 of the slab thickness and conduits shall be spaced not closer than 3 diameters on centers except at cabinet locations where the slab thickness shall be increased as approved by the Contracting Officer. Where conduit is run parallel to reinforcing steel, the conduit shall be spaced a minimum of one conduit diameter away but not less than 25.4 mmfrom the reinforcing steel.

3.2.1.5 Changes in Direction of Runs

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Care shall be taken to prevent the lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment during the course of construction. Clogged raceways shall be cleared of obstructions or shall be replaced.

3.2.1.6 Supports

Except where otherwise permitted by NFPA 70, conduits and tubing shall be securely and rigidly fastened in place at intervals of not more than 3 metersand within 900 mmof boxes, cabinets, and

fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, beam clamps, or ceiling trapeze. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structure. Loads shall not be applied to joist bridging. Attachment shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Cutting the main reinforcing bars in reinforced concrete beams or joists shall be avoided when drilling holes for support anchors. Holes drilled for support anchors, but not used, shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Raceways shall not be supported using wire or nylon ties. Raceways shall be independently supported from the structure. Upper raceways shall not be used as a means of support for lower raceways. Supporting means will not be shared between electrical raceways and mechanical piping or ducts. Cables and raceways shall not be supported by ceiling grids. Except where permitted by NFPA 70, wiring shall not be supported by ceiling support systems. Conduits shall be fastened to sheet-metal boxes and cabinets with two locknuts where required by NFPA 70, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

3.2.1.7 Exposed Raceways

Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Raceways under raised floors and above accessible ceilings shall be considered as exposed installations in accordance with NFPA 70definitions.

3.2.1.8 Exposed Risers

Exposed risers in wire shafts of multistory buildings shall be supported by U-clamp hangers at each floor level, and at intervals not to exceed 3 meters.

3.2.1.9 NOT USED

3.2.1.10 Communications Raceways

Communications raceways indicated shall be installed in accordance with the previous requirements for conduit and tubing and with the additional requirements that no length of run shall exceed 15 metersfor 15 mmand 20 mmsizes, and 30 metersfor 25 mmor larger sizes, and shall not contain more than two 90-degrees bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radii of bends in conduits of 25 mm (1 inch)size or larger shall not be less than ten times the nominal diameter.

3.2.2 NOT USED.

3.2.3 Cable Trays

Cable trays shall be supported in accordance with the recommendations of the manufacturer but at no more than 1.8 meterintervals. Contact surfaces of aluminum connections shall be coated with an antioxidant compound prior to assembly. Adjacent cable tray sections shall be bonded together by connector plates of an identical type as the cable tray sections. The Contractor shall submit the manufacturer's certification that the cable tray system meets all requirements of Article 318 of NFPA 70. The cable tray shall be installed and grounded in accordance with the provisions of Article 318 of NFPA 70. Data submitted by the Contractor shall demonstrate that the completed cable tray systems

will comply with the specified requirements. Cable trays shall terminate 250 mm from both sides of smoke and fire partitions. Conductors run through smoke and fire partitions shall be installed in 103 mm (4 inch)rigid steel conduits with grounding bushings, extending 300 mmbeyond each side of the partitions. The installation shall be sealed to preserve the smoke and fire rating of the partitions. Penetrations shall be firestopped in accordance with Section 07270 FIRESTOPPING.

3.2.4 Cables and Conductors

Installation shall conform to the requirements of NFPA 70. Covered, bare or insulated conductors of circuits rated over 600 volts shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 600 volts or less.

3.2.4.1 Sizing

Unless otherwise noted, all sizes are based on copper conductors and the insulation types indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 30 meterslong and of 277 volts more than 70 meterslong, from panel to load center, shall be no smaller than No. 10 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal circuit conductors shall be not less than No. 16 AWG. Class 3 low-energy, remote-control and signal circuits shall be not less than No. 22 AWG.

3.2.4.2 Use of Aluminum Conductors in Lieu of Copper

Aluminum conductors shall not be used.

3.2.4.3 Cable Systems

Cable systems shall be installed where indicated. Cables shall be installed concealed behind ceiling or wall finish where practicable. Cables shall be threaded through holes bored on the approximate centerline of wood members; notching of surfaces will not be permitted. Sleeves shall be provided through bond beams of masonry-block walls for threading cables through hollow spaces. Exposed cables shall be installed parallel or at right angles to walls or structural members. In rooms or areas not provided with ceiling or wall finish, cables and outlets shall be installed so that a room finish may be applied in the future without disturbing the cables or resetting the boxes. Exposed nonmetallic-sheathed cables less than 1.2 metersabove floors shall be protected from mechanical injury by installation in conduit or tubing.

3.2.4.4 NOT USED

3.2.4.5 Cable Splicing

Splices shall be made in an accessible location. Crimping tools and dies shall be approved by the connector manufacturer for use with the type of connector and conductor.

Copper Conductors, 600 Volt and Under: Splices in conductors No. 10 AWG and smaller diameter shall be made with an insulated, pressure-type connector. Splices in conductors No. 8 AWG and larger diameter shall be made with a solderless connector and insulated with tape or heat-shrink type insulating material equivalent to the conductor insulation.

3.2.4.6 Conductor Identification and Tagging

Power, control, and signal circuit conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Where several feeders pass through a common pull box,

the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation. Phase conductors of low voltage power circuits shall be identified by color coding. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

a. Color coding shall be provided for service, feeder, branch, and ground conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in the same raceway or box, other neutral shall be white with colored (not green) stripe. The color coding for three-phase and single-phase low voltage systems shall be as follows:

120/208-volt, 3-phase: Black(A), red(B), and blue(C).

277/480-volt, 3-phase: Brown(A), orange(B), and yellow(C).

b. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 75 mmof length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer.

c. Control and signal circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

3.3 BOXES AND SUPPORTS

Boxes shall be provided in the wiring or raceway systems where required by NFPA 70 for pulling of wires, making connections, and mounting of devices or fixtures. Pull boxes shall be furnished with screw-fastened covers. Indicated elevations are approximate, except where minimum mounting heights for hazardous areas are required by NFPA 70. Unless otherwise indicated, boxes for wall switches shall be mounted 1.2 meters above finished floors. Switch and outlet boxes located on opposite sides of fire rated walls shall be separated by a minimum horizontal distance of 600 mm. The total combined area of all box openings in fire rated walls shall not exceed 0.0645 square metersper 9.3 square meters.Maximum box areas for individual boxes in fire rated walls vary with the manufacturer and must not exceed the maximum specified for that box in UL-03. Only boxes listed in UL-03 shall be used in fire rated walls.

3.3.1 Box Applications

Each box shall have not less than the volume required by NFPA 70 for number of conductors enclosed in box. Boxes for metallic raceways, 102 by 102 mmnominal size and smaller, shall be of the cast-metal hub type when located in normally wet locations, when flush and surface mounted on outside of exterior surfaces, or when located in hazardous areas. Cast-metal boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. Boxes for mounting lighting fixtures shall be not less than 102 mmsquare, or octagonal, except smaller boxes may be installed as required by fixture configuration, as approved. Cast-metal boxes with 2.4 mm wall thickness are acceptable. Large size boxes shall be NEMA 1or as shown. Boxes in other locations shall be sheet steel except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit and tubing or nonmetallic sheathed cable system, when permitted by NFPA 70. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers.

3.3.2 Brackets and Fasteners

Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screw or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts, or nail-type nylon anchors may be used in lieu of expansion shields, or machine screws. Penetration of more than 38.1 mm (1-1/2 inches)into reinforced-concrete beams or more than 19.1 mm (3/4 inch)into reinforced-concrete joists shall avoid cutting any main reinforcing steel. The use of brackets which depend on gypsum wallboard or plasterboard for primary support will not be permitted. In partitions of light steel construction, bar hangers with 25 mmlong studs, mounted between metal wall studs or metal box mounting brackets shall be used to secure boxes to the building structure. When metal box mounting brackets are used, additional box support shall be provided on the side of the box opposite the brackets. This additional box support shall consist of a minimum 300 mmlong section of wall stud, bracketed to the opposite side of the box and secured by two screws through the wallboard on each side of the stud. Metal screws may be used in lieu of the metal box mounting brackets.

3.3.3 Mounting in Walls, Ceilings, or Recessed Locations

In walls or ceilings of concrete, tile, or other non-combustible material, boxes shall be installed so that the edge of the box is not recessed more than 6 mmfrom the finished surface. Boxes mounted in combustible walls or ceiling material shall be mounted flush with the finished surface. The use of gypsum or plasterboard as a means of supporting boxes will not be permitted. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. The bottom of boxes installed in masonry-block walls for concealed wiring shall be mounted flush with the top of a block to minimize cutting of the blocks, and boxes shall be located horizontally to avoid cutting webs of block. Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided.

3.3.4 Installation in Overhead Spaces

In open overhead spaces, cast-metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast-metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Hangers shall not be fastened to or supported from joist bridging. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than 600 mmfrom the box.

3.4 DEVICE PLATES

One-piece type device plates shall be provided for all outlets and fittings. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel, cast-metal, or impact resistant plastic having rounded or beveled edges. Plates on finished walls shall be of steel with baked enamel finish or impact-resistant plastic and shall be ivory. Screws shall be of metal with countersunk heads, in a color to match the finish of the plate. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1.6 mm. The use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and provided with a hinged, gasketed cover, unless otherwise specified.

3.5 RECEPTACLES

3.5.1 Single and Duplex, 15 or 20-ampere, 125 volt

Single and duplex receptacles shall be rated 20 amperes, 125 volts, two-pole, three-wire, grounding type with polarized parallel slots. Bodies shall be of ivory to match color of switch handles in the same room or to harmonize with the color of the respective wall, and supported by mounting strap having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side- or back-wired with two screws per terminal. The third grounding pole shall be connected to the metal mounting yoke. Switched receptacles shall be the same as other receptacles specified except that the ungrounded pole of each suitable receptacle shall be provided with a separate terminal. Only the top receptacle of a duplex receptacle shall be wired for switching application. Receptacles with ground fault circuit interrupters shall have the current rating as indicated, and shall be UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided as required by NFPA 70 and as indicated on the drawings.

3.5.2 NOT USED

3.5.3 Floor Outlets

Floor outlets shall be adjustable and each outlet shall consist of a cast-metal body with threaded openings for conduits, adjustable ring, and cover plate with 15 mmor 20 mmthreaded flush plug. Each telephone outlet shall consist of a horizontal cast housing with a receptacle as specified. Gaskets shall be used where necessary to ensure a watertight installation. Plugs with installation instructions shall be delivered to the Contracting Officer at the job site for capping outlets upon removal of service fittings.

3.5.4 Weatherproof Applications

Weatherproof receptacles shall be suitable for the environment, damp or wet as applicable, and the housings shall be labeled to identify the allowable use. Receptacles shall be marked in accordance with UL 514A for the type of use indicated; "Damp locations", "Wet Locations", "Wet Location Only When Cover Closed". Assemblies shall be installed in accordance with the manufacturer's recommendations.

3.5.4.1 Damp Locations

Receptacles in damp locations shall be mounted in an outlet box with a gasketed, weatherproof, cast-metal cover plate (device plate, box cover) and a gasketed cap (hood, receptacle cover) over each receptacle opening. The cap shall be either a screw-on type permanently attached to the cover plate by a short length of bead chain or shall be a flap type attached to the cover with a spring loaded hinge.

3.5.4.2 Wet Locations

Receptacles in wet locations shall be installed in an assembly rated for such use whether the plug is inserted or withdrawn, unless otherwise indicated. In a duplex installation, the receptacle cover shall be configured to shield the connections whether one or both receptacles are in use. .

3.5.5 Receptacles, 15-Ampere, 250-Volt

Receptacles, 15-ampere, 250-volt, shall be single two-pole, three-wire, grounding type with bodies of ivory phenolic compound supported by mounting yoke having plaster ears. The third grounding pole shall be connected to the metal yoke. Each receptacle shall be provided with a mating cord-grip plug.

3.5.6 Receptacles, 20-Ampere, 250-Volt

Receptacles, single, 20-ampere, 250-volt, shall be ivory molded plastic, two-pole, three-wire or three-pole, four-wire, grounding type complete with appropriate mating cord-grip plug.

3.5.7 Receptacles, 30-Ampere, 125/250-Volt

Receptacles, single, 30-ampere, 125/250-volt, shall be molded-plastic, three-pole,three-wire, non-grounding type , complete with appropriate mating cord-grip type attachment plug. Each dryer receptacle shall be furnished with a non-detachable power supply cord for connection to the electric clothes dryer. The cord shall be an angle-type 900 mm length of Type SRD, SRDE , range and dryer cable with three No. 10 AWG conductors.

3.5.8 Receptacles, 30-Ampere, 250-Volt

Receptacles, single, 30-ampere, 250-volt, shall be molded-plastic, three-pole, three-wire type, complete with appropriate mating cord-grip plug.

3.5.9 Receptacles, 50-Ampere, 125/250-Volt

Receptacles, single 50-ampere, 125/250-volt, shall be flush, molded plastic, three-pole, three-wire, non-grounding type. Each range receptacle shall be furnished with a nondetachable power supply cord for connection to the electric range. The cord shall be an angle-type 900 mm length of SRD ,SRDE , SRDT range and dryer cable with one No. 8 and two No. 6 AWG conductors.

3.5.10 Receptacles, 50-Ampere, 250-Volt

Receptacles, single, 50-ampere, 250-volt, shall be flush molded plastic, three-pole, three-wire type, complete with appropriate mating cord-grip plug.

3.5.11 Special-Purpose or Heavy-Duty Receptacles

Special-purpose or heavy-duty receptacles shall be of the type and of ratings and number of poles indicated or required for the anticipated purpose. Contact surfaces may be either round or rectangular. One appropriate straight or angle-type plug shall be furnished with each receptacle. Locking type receptacles, rated 30 amperes or less, shall be locked by rotating the plug. Locking type receptacles, rated more than 50 amperes, shall utilize a locking ring.

3.6 WALL SWITCHES

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall be ivory. Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than one switch shall be installed in a single-gang position. Switches shall be rated 20-ampere 120-volt for use on alternating current only. Pilot lights indicated shall consist of yoke-mounted candelabra-base sockets rated at 75 watts, 125 volts, and fitted with glass or plastic jewels. A clear 6-watt lamp shall be furnished and installed in each pilot switch. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be red. Dimming switches shall be solid-state flush mounted, sized for the loads.

3.7 SERVICE EQUIPMENT

Service-disconnecting means shall be of the type indicated with an external handle for manual operation. When service disconnecting means is a part of an assembly, the assembly shall be listed as suitable for service entrance equipment. Enclosures shall be sheet metal with hinged cover for surface mounting unless otherwise indicated.

3.8 PANELBOARDS AND LOADCENTERS

Circuit breakers and switches used as a motor disconnecting means shall be capable of being locked in the open position. Door locks shall be keyed alike. Nameplates shall be as approved. Directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering. Busses shall be copper .

3.8.1 Loadcenters

Loadcenters shall be circuit breaker equipped.

3.8.2 Panelboards

Panelboards shall be circuit breaker or fusible switch equipped as indicated on the drawings.

3.9 FUSES

Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilize fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination.

3.9.1 Cartridge Fuses; Noncurrent-Limiting Type

Cartridge fuses of the noncurrent-limiting type shall be Class H, nonrenewable, dual element, time lag type and shall have interrupting capacity of 10,000 amperes. At 500 percent current, cartridge fuses shall not blow in less than 10 seconds.

3.9.2 Cartridge Fuses; Current-Limiting Type

Cartridge fuses, current-limiting type, Class G, J,L ,RK1, RK5, RK9,T,CC shall have tested interrupting capacity not less than 100,000 amperes. Fuse holders shall be the type that will reject all Class H fuses.

3.9.3 NOT USED

3.9.4 NOT USED

3.9.5 Motor and Transformer Circuit Fuses

Motor, motor controller, transformer, and inductive circuit fuses shall be Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.

3.10 UNDERGROUND SERVICE

Unless otherwise indicated, interior conduit systems shall be stubbed out 1.5 mbeyond the building wall and 600 mm below finished grade, for interface with the exterior service lateral conduits. Outside conduit ends shall be bushed when used for direct burial service lateral conductors. Outside conduit ends shall be capped or plugged until connected to exterior conduit systems. Underground service lateral conductors will be extended to building service entrance and terminated in accordance with the requirements of Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and NFPA 70.

3.11 NOT USED

3.12 MOTORS

Each motor shall conform to the kWand voltage ratings indicated, and shall have a service factor and other characteristics that are essential to the proper application and performance of the motors under conditions shown or specified. Three-phase motors for use on 3-phase 208-volt systems shall have a nameplate rating of 200 volts. Unless otherwise specified, all motors shall have open frames, and continuous-duty classification based on a 40 degree C ambient temperature reference. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low-starting-current characteristics, unless other characteristics are specified in other sections of these specifications or shown on contract drawings. The Contractor shall be responsible for selecting the actual kilowatt (horsepower)ratings and other motor requirements necessary for the applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

3.13 MOTOR CONTROL

Each motor or group of motors requiring a single control and not controlled from a motor-control center shall be provided under other sections of these specifications with a suitable controller and devices that will perform the functions as specified for the respective motors. Each motor of 93 W (1/8 hp)or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating. Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motors directly, provided the devices used are designed for that purpose and have an adequate kilowattrating. When the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit. When combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch shall be provided for the manual control; when the automatic-control device actuates the pilot control circuit of a magnetic starter, the latter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low- or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

3.13.1 NOT USED

3.13.2 NOT USED

3.13.3 Contacts

Unless otherwise indicated, contacts in miscellaneous control devices such as float switches, pressure switches, and auxiliary relays shall have current and voltage ratings in accordance with NEMA ICS 2 for rating designation B300.

3.13.4 Safety Controls

Safety controls for boilers shall be connected to a 2-wire, 120 volt grounded circuit supplied from the associated boiler-equipment circuit. Where the boiler circuit is more than 120 volts to ground, safety controls shall be energized through a two-winding transformer having its 120 volt secondary winding grounded. Overcurrent protection shall be provided in the ungrounded secondary conductor and shall be sized for the load encountered.

3.14 MOTOR-DISCONNECT MEANS

Each motor shall be provided with a disconnecting means when required by NFPA 70 even though not indicated. For single-phase motors, a single or double pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Switches shall disconnect all ungrounded conductors.

3.15 TRANSFORMER INSTALLATION

Three-phase transformers shall be connected only in a delta-wye or wye-delta configuration as indicated. "T" connections may be used for transformers rated at 15 kVA or below. Dry-type transformers shown located within 1.5 metersof the exterior wall shall be provided in a weatherproof enclosure. Transformers to be located within the building may be provided in the manufacturer's standard, ventilated indoor enclosure designed for use in 40 degrees C ambient temperature, unless otherwise indicated.

3.16 LAMPS AND LIGHTING FIXTURES

Ballasted fixtures shall have ballasts which are compatible with the specific type and rating of lamps indicated and shall comply with the applicable provisions of the publications referenced.

3.16.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed in the fixtures just prior to the completion of the project.

3.16.1.1 Incandescent

Incandescent lamps shall be for 125-volt operation unless otherwise indicated.

3.16.1.2 Fluorescent

Fluorescent lamps for magnetic ballasts shall be as indicated and shall be of a type that will not require starter switches. Lamps shall be of the rapid-start type unless otherwise shown or approved. Fluorescent lamps for electronic ballasts shall be as indicated.

3.16.1.3 High-Intensity-Discharge

High-intensity-discharge lamps shall be the high-pressure sodium type unless otherwise indicated, shown, or approved.

3.16.2 Fixtures

Fixtures shall be as shown and shall conform to the following specifications and shall be as detailed on Standard Drawing No. 40-06-04, Sheet Nos. 19, 20, 23, 32, 36, 38, 39, 41, 49, 56, 60, 66, 67, which

accompany and form a part of this specification for the types indicated. Illustrations shown on these sheets are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar designs and equivalent energy efficiency, light distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved. In suspended acoustical ceilings with fluorescent fixtures, the fluorescent emergency light fixtures shall be furnished with self-contained battery packs.

3.16.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation. Open type fluorescent fixtures with exposed lamps shall have a wire-basket type guard.

3.16.2.2 Suspended Fixtures

Suspended fixtures shall be provided with swivel hangers in order to ensure a plumb installation. Pendants, rods, or chains 1.2 metersor longer excluding fixture, shall be braced to limit swinging. Bracing shall be 3 directional, 120 degrees apart. Single unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple unit or continuous-row fluorescent units shall have a tubing or stem for wiring at one point, and a tubing or rod suspension provided for each length of chassis including one at each end. Maximum distance between adjacent tubing or stems shall be 3.1 meters. Rods shall be of not less than 4.8 mm (3/16 inch)diameter. Flexible raceway shall be installed to each fixture from an overhead junction box. Fixture to fixture wiring installation is allowed only when fixtures are installed end to end in a continuous run.

3.16.2.3 Ceiling Fixtures

Ceiling fixtures shall be coordinated with and suitable for installation in, on, or from the suspended ceiling provided under other sections of these specifications. Installation and support of fixtures shall be in accordance with the NFPA 70 and manufacturer's recommendations. Recessed fixtures shall have adjustable fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive type of suspended ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling panels, in conformance with UL-03. Surface-mounted fixtures shall be suitable for fastening to the structural support for ceiling panels.

3.16.2.4 Sockets

Sockets of industrial, strip, and other open type fluorescent fixtures shall be of the type requiring a forced movement along the longitudinal axis of the lamp for insertion and removal of the lamp.

3.16.3 Emergency Light Sets

Emergency light sets shall conform to UL 924 with the number of heads as indicated. Sets shall be permanently connected to the wiring system by conductors installed in short lengths of flexible conduit.

3.17 NOT USED

3.18 EQUIPMENT CONNECTIONS

All wiring not furnished and installed under other sections of the specifications for the connection of electrical equipment as indicated on the drawings shall be furnished and installed under this section of the specifications. Connections shall comply with the applicable requirements of paragraph WIRING METHODS. Flexible conduits 2 mor less in length shall be provided to all electrical equipment subject

to periodic removal, vibration, or movement and for all motors. All motors shall be provided with separate grounding conductors. Liquid-tight conduits shall be used in damp or wet locations.

3.18.1 Motors and Motor Control

Motors, motor controls, and motor control centers shall be installed in accordance with NFPA 70, the manufacturer's recommendations, and as indicated. Wiring shall be extended to motors, motor controls, and motor control centers and terminated.

3.18.2 Installation of Government-Furnished Equipment

Wiring shall be extended to the equipment and terminated.

3.18.3 Food Service Equipment Provided Under Other Sections

Wiring shall be extended to the equipment and terminated.

3.19 CIRCUIT PROTECTIVE DEVICES

The Contractor shall calibrate, adjust, set and test each new adjustable circuit protective device to ensure that they will function properly prior to the initial energization of the new power system under actual operating conditions.

3.20 PAINTING AND FINISHING

Field-applied paint on exposed surfaces shall be provided under Section 09900 PAINTING, GENERAL.

3.21 NOT USED

3.22 FIELD TESTING

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 15 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspection recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports will be signed and dated by the Contractor.

3.22.1 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.22.2 Ground-Resistance Tests

The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Soil resistivity in the area of the grid shall be measured concurrently with the grid measurements. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the

systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

3.22.3 NOT USED

3.22.4 Cable Tests

The Contractor shall be responsible for identifying all equipment and devices that could be damaged by application of the test voltage and ensuring that they have been properly disconnected prior to performing insulation resistance testing. An insulation resistance test shall be performed on all low and medium voltage cables after the cables are installed in their final configuration and prior to energization. The test voltage shall be 500 volts DC applied for one minute between each conductor and ground and between all possible combinations of conductors. The minimum value of resistance shall be:

R in megohms = (rated voltage in kV + 1) x 304,800/(length of cable in meters)

Each cable failing this test shall be repaired or replaced. The repaired cable system shall then be retested until failures have been eliminated.

3.22.4.1 NOT USED

3.22.4.2 Low Voltage Cable Tests

a. Continuity test.

b. Insulation resistance test.

3.22.5 NOT USED

3.22.6 Motor Tests

a. Phase rotation test to ensure proper directions.

b. Operation and sequence of reduced voltage starters.

c. High potential test on each winding to ground.

d. Insulation resistance of each winding to ground.

e. Vibration test.

f. Dielectric absorption test on motor.

3.22.7 NOT USED

3.22.8 Dry-Type Transformer Tests

The following field tests shall be performed on all dry-type transformers.

a. Insulation resistance test phase-to-ground, each phase.

b. Turns ratio test.

3.22.9 Circuit Breaker Tests

The following field tests shall be performed on circuit breakers.

3.22.9.1 NOT USED

3.22.9.2 Circuit Breakers, Low Voltage

a. Insulation resistance test phase-to-phase, all combinations.

b. Insulation resistance test phase-to-ground, each phase.

c. Closed breaker contact resistance test.

d. Manual and electrical operation of the breaker.

3.22.9.3 Circuit Breakers, Molded Case

a. Insulation resistance test phase-to-phase, all combinations.

b. Insulation resistance test phase-to-ground, each phase.

c. Closed breaker contact resistance test.

d. Manual operation of the breaker.

3.22.10 NOT USED

3.22.11 NOT USED

3.23 OPERATING TESTS

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph FIELD TEST REPORTS.

3.24 FIELD SERVICE

3.24.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 16 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals.

3.24.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of equipment, assist in the performance of the onsite tests, oversee initial operations, and instruct personnel as to the operational and maintenance features of the equipment.

3.25 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION DISCOM Barracks Complex Phase 1, Fort Campbell, KY				CONTRACTOR									SPEC. SECTION 16415	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.3 SUBMITTALS										
			SD-01 Data										
		1	Manufacturer's Catalog; GA.										
		2	Material, Equipment, and Fixture Lists; FIO.										
			SD-04 Drawings										
		3	Interior Electrical Equipment; GA.										
			SD-08 Statements										
		4	On-Site Test; GA.										
			SD-09 Reports										
		5	Factory Test Reports; GA.										
		6	Field Test Plan; GA.										
		7	Field Test Reports; GA.										
			SD-13 Certificates										
		8	Materials and Equipment; GA.										

***** SAFETY PAYS *****

SECTION 16528

EXTERIOR LIGHTING INCLUDING SECURITY AND CCTV APPLICATIONS

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***** SAFETY PAYS *****

SECTION 16528

EXTERIOR LIGHTING INCLUDING SECURITY AND CCTV APPLICATIONS

02/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS(AASHTO)

AASHTO LTS-2	(1985; Rev 1986, 1987, 1988) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C2	(1993) National Electrical Safety Code
ANSI C78.1	(1991; C78.1a) Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics
ANSI C78.1375	(1990) 400-Watt, M59 Single-Ended Metal-Halide Lamps
ANSI C78.1376	(1990) 1000-Watt, M47 Single-Ended Metal-Halide Lamps
ANSI C80.1	(1990) Rigid Steel Conduit - Zinc Coated
ANSI C119.1	(1986) Sealed Insulated Underground Connector Systems Rated 600 Volts
ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction
ANSI C136.2	(1985) Luminaires Voltage Classification
ANSI C136.10	(1988) Locking-type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing for Roadway Lighting Equipment

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1994a) Carbon Structural Steel
ASTM A 48	(1994a) Gray Iron Castings
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153	(1982; R 1987) Zinc Coating (Hot-Dip) on Iron and Steel

Hardware

ASTM A 575	(1989) Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A 576	(1990b) Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM B 2	(1988) Medium-Hard-Drawn Copper Wire
ASTM B 8	(1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 117	(1994) Operating Salt Spray (Fog) Testing Apparatus
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA 232-E	(1991) Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991) Surge Voltages in Low-Voltage AC Power Circuits
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(1993) Industrial Controls and Systems
NEMA ICS 2	(1993) Industrial Control Devices, Controllers and Assemblies
NEMA ICS 6	(1993) Enclosures for Industrial Control and Systems
NEMA OS 1	(1989) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA OS 2	(1986; Errata Aug 1986; R 1991) Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
NEMA RN 1	(1989) Polyvinyl-Chloride (PVC) Externally Coated

	Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA TC 9	(1990) Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6	(1993) Rigid Metal Conduit
UL 44	(1991; Rev thru Jan 1995) Rubber-Insulated Wires and Cables
UL 98	(1994; Rev Feb 1995) Enclosed and Dead-Front Switches
UL 467	(1993) Grounding and Bonding Equipment
UL 486A	(1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 514A	(1991) Metallic Outlet Boxes
UL 514B	(1992; Rev thru Apr 1995) Fittings for Conduit and Outlet Boxes
UL 514C	(1988; Rev Apr 1995) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 651	(1989; Rev thru Dec 1989) Schedule 40 and 80 Rigid PVC Conduit
UL 651A	(1989; Rev thru Dec 1989) Type EB and A Rigid PVC Conduit and HDPE Conduit
UL 854	(1991; Rev thru Apr 1993) Service-Entrance Cables
UL 870	(1991) Wireways, Auxiliary Gutters, and Associated Fittings
UL 1572	(1991; Rev thru Jul 1994) High Intensity Discharge Lighting Fixtures

1.2 SYSTEM DESCRIPTION

1.2.1 Lighting System

The lighting system shall be configured as specified and shown. The system shall include all fixtures, hardware, poles, cables, connectors, adapters and appurtenances needed to provide a fully functional lighting system.

1.2.2 NOT USED

1.2.3 Electrical Requirements

The equipment shall operate from a voltage source as shown, plus or minus 10 percent, and 60 Hz, plus or minus 2 percent.

1.2.4 NOT USED

1.2.5 NOT USED

1.2.6 Interface Between Lighting System and Power Distribution

Conductors shall be as indicated.

1.2.7 Nameplates

Each major component of equipment shall have a nonferrous metal or engraved plastic nameplate which shall show, as a minimum, the manufacturer's name and address, the catalog or style number, the electrical rating in volts, and the capacity in amperes or watts.

1.2.8 Standard Products

Materials and equipment shall be standard products of manufacturer regularly engaged in the manufacture of such products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.2.9 thru 1.2.11 NOT USED

1.3 CORROSION PROTECTION

1.3.1 Aluminum Materials

Aluminum shall not be used in contact with earth or concrete. Where aluminum conductors are connected to dissimilar metal, fittings conforming to UL 486B shall be used.

1.3.2 Ferrous Metal Materials

1.3.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153 and ASTM A 123.

1.3.2.2 Equipment

Equipment and component items, including but not limited to metal poles and ferrous metal luminaires not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1.6 mm (1/16 inch)from the test mark. The scribed test mark and test evaluation shall have a rating of not less than 7 in accordance with TABLE 1, (procedure A) of ASTM D 1654. Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

1.3.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory, shall be as specified in Section 09900 PAINTING, GENERAL.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment and Materials; GA.

Data published by the manufacturer of each item on the list of equipment and material, to permit verification that the item proposed is of the correct size, properly rated or applied, or is otherwise suitable for the application and fully conforms to the requirements specified.

Spare Parts; FIO.

Spare parts data for each item of material and equipment specified, after approval of detail drawings for materials and equipment, and not later than 4 months before the date of beneficial occupancy. The data shall include a complete list of parts, special tools, and supplies, with current unit prices and sources of supply.

SD-04 Drawings

Lighting System; GA.
Detail drawings for the complete system and for poles and lighting fixtures. Drawings shall include design calculations showing adequate strength of screw foundations.

Operating Test; GA.

Test procedures and reports for the Operating Test. After receipt by the Contractor of written approval of the test procedures, the Contractor shall schedule the tests. The final test procedures report shall be delivered after completion of the tests.

Ground Resistance Measurements; FIO.

The measured resistance to ground of each separate grounding installation, indicating the location of the rods, the resistance of the soil in ohms per millimeter and the soil conditions at the time the measurements were made. The information shall be in writing.

SD-19 Operation and Maintenance Manuals

Lighting System; FIO.

A draft copy of the operation and maintenance manuals, prior to beginning the tests for use during site testing. Final copies of the manuals as specified bound in hardback, loose-leaf binders, within 30 days after completing the field test. The draft copy used during site testing shall be updated with any changes required, prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the field test shall include modifications made during installation checkout and acceptance.

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 BRACKET ARMS

2.2.1 On Aluminum, Steel, Fiberglass, and Concrete Poles

Poles shall be provided with bracket arms of the support arm style and of the length indicated on drawings. Bracket arms shall conform to the design of the pole provided. The bracket arms shall be capable of supporting the equipment to be mounted on it with the maximum wind and ice loading encountered at the site. Strength of bracket arms shall be in accordance with ANSI C136.13. Steel brackets shall be galvanized. Wood bracket arms shall not be used.

2.2.2 NOT USED

2.2.3 Floodlight Brackets

Floodlight brackets shall be coordinated with the floodlight support provided.

2.3 CABLE

The Contractor shall provide all wire and cable not indicated as government furnished equipment. Wire and cable components shall be able to withstand the jobsite environment for a minimum of 20 years.

2.3.1 Insulated Cable

Cable shall be type USE conforming to UL 854, with copper conductors and type RHW or XHHW insulation conforming to UL 44, and shall include green ground conductor. Cable shall be provided with insulation of a thickness not less than that given in column B of TABLE 15.1 of UL 854. Cable shall be rated 600 volts. Parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded.

2.3.2 NOT USED

2.3.3 Bare Copper Conductors

Medium-hard-drawn copper conductors shall conform to ASTM B 2 and ASTM B 8.

2.4 NOT USED

2.5 CABLE SPLICES AND CONNECTORS

Cable splices and connectors shall conform to UL 486A. Underground splices and connectors shall also conform to the requirements of ANSI C119.1.

2.6 CABLE BOXES

Boxes and covers shall be made of cast iron with zinc coated or aluminized finish, and shall be of the sizes indicated on drawings. The minimum inside dimensions shall be not less than

2.8 CONDUIT, DUCTS AND FITTINGS

2.8.1 Conduit, Rigid Steel

Rigid steel conduit shall conform to ANSI C80.1 and UL 6.

2.8.2 Conduit Coatings

Underground metallic conduit and fittings shall be coated with a plastic resin system conforming to NEMA RN 1, Type 40. Epoxy systems may also be used.

2.8.3 Conduit Fittings and Outlets

2.8.3.1 Boxes, Metallic Outlets

NEMA OS 1 and UL 514A.

2.8.3.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

NEMA OS 2 and UL 514C.

2.8.3.3 NOT USED

2.8.3.4 Boxes, Switch (Enclosed), Surface Mounted

UL 98.

2.8.3.5 Fittings for Conduit and Outlet Boxes

UL 514B.

2.8.3.6 NOT USED.

2.8.3.7 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

UL 514B.

2.8.4 Non-Metallic Duct

Non-metallic duct lines and fittings utilized for underground installation shall be suitable for the application. Duct shall be thick-wall, single, round-bore type. Material of one type shall be used. Acrylonitrile-butadiene-styrene (ABS) duct shall conform to NEMA TC 6and NEMA TC 9. High-density conduit shall conform to UL 651A. Schedule 40 polyvinyl chloride (PVC) shall conform to UL 651. Plastic utility duct and fittings manufactured without a UL label or listing shall be provided with a certification as follows: "The materials are suitable for use with

2.10 GROUND RODS

Ground rods shall be of copper clad steel conforming to UL 467 not less than 19.1 mm (3/4 inch)in diameter by 3.1 m (10 feet)in length of the sectional type driven full length into earth.

2.11 POLES

Metal and concrete poles shall be the pole manufacturer's standard design for supporting the number of fixtures indicated. Poles shall be designed for a wind velocity of 35.8 meters per second (80 mph)at the base of the pole, for a wind gust factor of 1.3, and for the height and drag factors recommended by AASHTO LTS-2. The effective projected area of luminaires and other pole-mounted devices shall be taken into account in pole design. Poles shall have grounding provisions. The type of pole shaft material provided shall not be mixed on any project. Grounding connection shall be provided near the bottom of each metal pole and at each concrete pole anchor base. Scratched, stained, chipped, or dented poles shall not be installed.

2.11.1 Aluminum Poles

Aluminum poles and brackets for lighting shall have a uniform satin finish to match fixtures and shall not be painted. Manufacturer's standard provision shall be made for protecting the finish during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes.

a. Shafts shall be round and of seamless construction. The wall thickness shall be at least 4.8 mm (0.188 in).Exterior surfaces shall be free of protuberances, dents, cracks, and discoloration. Material for shafts shall be 6063 aluminum alloy; after fabrication, the alloy shall have a T6 temper. Tops of shafts shall be fitted with a round or tapered cover. Bases shall be anchor bolt mounted, made of cast aluminum alloy 356-T6, and shall be machined to receive the lower end of shafts. Joints between shafts and bases shall be welded. Bases shall be provided with four holes, spaced 90 degrees apart, for anchorage.

b. Hardware, except anchor bolts, shall be either 2024-T4 anodized aluminum alloy or stainless steel.

2.11.2 thru 2.11.5 NOT USED

2.11.6 Anchor Bolts

Anchor bolts shall be the pole manufacturer's standard, but not less than necessary to meet the pole wind and ice loading, herein and other specified design requirements.

2.12 POLE LINE HARDWARE

Zinc coated hardware shall conform to ANSI C135.1 and ANSI C135.14, and steel hardware material shall conform to ASTM A 575 and ASTM A 576. Hardware shall be hot-dip galvanized in accordance with ASTM A 153.

2.13 NOT USED

2.14 NOT USED

2.15 ILLUMINATION

2.15.1 General Lighting

Luminaires, ballasts, lamps, and control devices required for general area sidewalk lighting, including floodlighting shall be in accordance with sheets 51, 60 of Standard Detail No. 40-06-04, attached to these specifications.

2.15.2 NOT USED

2.16 LAMPS AND BALLASTS, HIGH INTENSITY DISCHARGE (HID) SOURCES

2.16.1 NOT USED

2.16.2 NOT USED
2.16.3 Metal-Halide

Lamps shall be made by a manufacturer with not less than 5 years experience in making metal-halide lamps. Metal-halide lamps shall conform to ANSI C78.1375 or ANSI C78.1376. Ballasts shall conform to ANSI C82.4or UL 1029.

2.17 NOT USED

2.18 NOT USED

2.19 LUMINAIRE COMPONENTS

Luminaire components shall conform to the following: attachments, ANSI C136.3; voltage classification, ANSI C136.2; field identification marking, ANSI C136.15; interchangeability, ANSI C136.6 and ANSI C136.9; and sockets, ANSI C136.11.

2.20 LIGHTING CONTROL EQUIPMENT

2.20.1 Photo-Control Devices

Photo-control devices shall conform to ANSI C136.10. Each photo-control element shall be a replaceable, weatherproof, plug-in or twist-lock assembly adjustable operation range of approximately

2.20.3 NOT USED

2.20.4 Safety Switches

Switches shall be the heavy-duty type with NEMA ICS 6 Type 4 enclosures and shall be suitable for operation on a 240 volt, 60 Hz, three-phase system. Switch construction shall be such that a screwdriver will be required to open the switch door when the switch is on. Blades shall be visible with door open and shall be of the quick-make, quick-break type. Terminal lugs shall be coordinated with the wire size. Switches shall conform to UL 98.

2.20.5 NOT USED

2.21 PHOTOMETRIC DISTRIBUTION CLASSIFICATION

Photometrics shall conform to IESNA ARP-8.

2.22 LUMINAIRES, FLOODLIGHTING

2.22.1 HID and Incandescent

HID lighting fixtures shall conform to UL 1572. Incandescent lighting fixtures shall conform to UL 1571.

2.22.2 NOT USED

2.23 FIXTURES

Standard fixtures shall be as detailed on Standard Detail No. 40-06-04, Sheet Nos. 51, 60 which accompany and form a part of this specification. Special fixtures shall be as indicated on the drawings. Illustrations shown on these sheets or on the drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar design, equivalent light distribution and brightness characteristics, equal finish and quality will be acceptable as approved.

2.23.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

2.23.2 NOT USED

2.23.3 In-Line Fuse

An in-line fuse shall be provided for each fixture, and shall consist of a fuse and a UL approved waterproof fuse holder rated at 30 amperes, 600 volts, with insulated boots. Fuse rating shall be 600 volts.

2.24 thru 2.28 NOT USED

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall install all system components, including government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, ANSI C2, and contract documents, and shall furnish necessary hardware, fixtures, cables, wire, connectors, interconnections, services, and adjustments required for a complete and operable system.

3.1.1 Current Site Conditions

The Contractor shall verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Government. The Contractor shall not take any corrective action without written permission from the Government.

3.1.2 NOT USED

3.2 ENCLOSURE PENETRATIONS

Enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer, and in such a manner that the cable is not damaged.

3.3 PREVENTION OF CORROSION

3.3.1 Aluminum

Aluminum shall not be used in contact with earth or concrete, and where connected to dissimilar metal, shall be protected by approved fittings and treatment.

3.3.2 Steel Conduits

Steel conduits shall not be installed within concrete slabs-on-grade. Steel conduits installed underground or under slabs-on-grade, or penetrating slabs-on-grade, shall be field wrapped with
Cable and all parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded. Each circuit shall be identified by means of fiber or nonferrous metal tags, or approved equal, in each junction box, and at each terminal.

3.4.1 Splices

Splices below grade shall be made with nonpressure-filled resin systems using transparent, interlocking, self-venting, longitudinally split plastic molds. Splices above grade shall be made with sealed insulated pressure connectors and shall provide insulation and jacket equal to that of the cable. In order to prevent moisture from entering the splice, jackets shall be cut back to expose the required length of insulation between the jacket and the tapered end of the insulation.

3.4.2 Installation in Duct Lines

Ground conductors shall be installed in duct with the associated phase conductors. Cable splices shall be made in handholes only.

3.5 thru 3.7 NOT USED

3.8 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated and shall be properly connected to the indicated equipment. Empty conduits to the indicated equipment from a point are specified in Section 16415 ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed to prevent moisture or gases from entering the building.

3.9 DUCT LINES

3.9.1 Requirements

Numbers and size of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of

3.9.4 Nonencased Direct-Burial

Top of duct lines shall be below the frost line depth of 457 mm, but not less than 610 mm below finished grade and shall be installed with a minimum of layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least The first 150 mm layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in at 28 days, except that reinforced concrete shall be 21 MPa (3000 psi)at 28 days. Duct line encasement shall be of monolithic construction. Where a connection is made to an existing duct line, the concrete encasement shall be well bonded or doweled to the existing encasement.

3.9.7 Duct Line Markers

Duct line markers shall be provided at the ends of long duct line stubouts or for other duct locations that are indeterminate because of duct curvature or terminations at completely below-grade structures. In addition to markers, a on centers with a continuous metallic backing and a corrosion-resistant 0.0254 mm (1 mil)metallic foil core to permit easy location of the duct line, shall be placed approximately

3.11 POLE INSTALLATION

Pole lengths shall provide a luminaire mounting height as indicated. The mount interfaces shall have ac power connected, and the pole wiring harness shall be connected to the luminaire. Light poles shall not be installed outside the site or inside the perimeter zone. Pole installation shall conform to the manufacturer's recommendations, NFPA 70, and ANSI C2. Poles shall be set straight and plumb.

3.11.1 Pole Brackets

Brackets shall be installed as specified by the manufacturer and as shown on drawings. Mounting hardware shall be sized appropriately to secure the mount, luminaire, and housing with wind and ice loading normally encountered at the site. Pole brackets for floodlights shall have the number of tenons indicated, arranged to provide the indicated spread between each tenon. Where indicated on drawings, adjustable heads shall be installed on the brackets to position the luminaires. Identical brackets shall be used with one type of luminaire.

3.11.2 Concrete Foundations

Concrete foundations shall have anchor bolts accurately set in the foundation using a template supplied by the pole manufacturer. Once the concrete has cured, the pole shall be set on the foundation, leveled on the foundation bolts, and secured with the holding nuts. The space between the foundation and the pole base shall be grouted. Concrete and grout work shall conform to Section 03300 CONCRETE FOR BUILDING CONSTRUCTION. Concrete shall be

3.11.4 NOT USED

3.11.5 Aluminum, Steel, Fiberglass and Concrete Pole Installation

Poles shall be mounted on cast-in-place or power-installed screw foundations. Concrete poles shall be embedded in accordance with the details shown. Conduit elbows shall be provided for cable entrances into pole interiors.

3.11.5.1 Cast-In-Place Foundations

Concrete foundations, sized as indicated, shall have anchor bolts accurately set in foundations using templates supplied by the pole manufacturer. Concrete work and grouting is specified in Section 03300CONCRETE FOR BUILDING CONSTRUCTION. After the concrete has cured, pole anchor bases shall be set on foundations and leveled by shimming between anchor bases and foundations or by setting anchor bases on leveling nuts and grouting. Poles shall be set plumb. Anchor bolts shall be the manufactures standard, and not less than necessary to meet the pole wind loading and other specified design requirements.

3.11.5.2 Power-Installed Screw Foundations

Power-installed screw foundations having the required strength mounting bolt, and top plate dimensions may be utilized. Screw foundations shall be of at least

3.12.1 Lamps

Lamps of the proper type, wattage, and voltage rating shall be delivered to the project in the original containers and installed in the fixtures just before completion of the project.

3.12.2 Fixture Installation

Standard fixtures shall be installed as detailed on Standard Detail No. 04-06-04, Sheet Nos. 51 and 60, which accompany and form a part of this specification. Special fixtures shall be as indicated on drawings. Illustrations shown on these sheets or on the drawings are indicative of the general type desired and are not intended to restrict selection of fixtures to any particular manufacturer. Fixtures of similar design, equivalent light-distribution and brightness characteristics, and equal finish and quality will be acceptable as approved.

3.12.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be installed as required for proper installation.

3.12.2.2 In-Line Fuses

An in-line fuse shall be provided for each fixture.

3.12.2.3 NOT USED

3.13 NOT USED

3.14 LIGHTING CONTROL SYSTEM

3.14.1 Photo-Control

Lighting luminaires shall be individually controlled by photo-control elements mounted on the heads of the luminaires.

3.14.2 NOT USED

3.14.3 Manual and Safety Switches

Terminal lugs shall be coordinated with the wire size. Switches shall be securely fastened to the supporting structure or wall using not less than four

3.15 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following. Grounding conductors shall be soft-drawn, stranded copper. Ground rods shall be driven into the earth so that after the installation is complete, the top of the ground rod will be approximately

3.15.1 Ground Rods and Pole Butt Electrodes

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground rod shall not exceed 25 ohms under normally dry conditions. Whenever the required ground resistance is not met, additional electrodes shall be provided interconnected with grounding conductors, to achieve the specified ground resistance. The additional electrodes shall be driven perpendicular to grade coupled and driven with the first rod. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.15.2 Items to be Grounded

Ground conductors, metallic conduits, junction boxes, and noncurrent-carrying metallic parts of equipment shall be grounded. Connections above grade shall be made with solderless connectors, and those below grade shall be made by a fusion-welding process.

3.15.3 Lighting Pole

One ground rod shall be provided at each pole. Bases of metal or concrete lighting poles shall be connected to ground rods by means of No. 8 AWG bare copper wire. Lighting fixture brackets on wood and concrete poles shall be grounded to a No. 6 AWG bare copper grounding conductor connected to the ground rod.

3.15.4 NOT USED

3.15.5 Metal Cable Boxes

Metal cable boxes for direct-burial cable shall be connected to adjacent ground rods by wires with current-carrying capacities of at least 20 percent of the spliced phase conductors, but not less than No. 6 AWG.

3.16 TESTS

3.16.1 NOT USED

3.16.2 Operating Test

After the installation is completed and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements specified. The test shall be performed in the presence of the Contracting Officer. The Contractor shall furnish instruments and personnel required for the test, and the Government will furnish the necessary electric power.

3.16.3 Ground Resistance Measurements

The resistance to ground shall be measured by the fall-of-potential method described in IEEE Std 81.

The contractor shall maintain a separate set of drawings, elementary diagrams and wiring diagrams of the lighting to be used for "as-built" drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the lighting system. In addition to being complete and accurate, this set of drawings shall be kept neat and shall not be used for installation purposes. Upon completion of the as-built drawings, a representative of the Government will review the as-built work with the Contractor. If the as-built work is not complete, the Contractor will be so advised and shall complete the work as required.

--END OF SECTION--

Corps of Engineers Department of the Army

TYPE 401
Enclosed, Integrally Ballasted, Rectangular Shaped,
Side Mounted, High Intensity Discharge Lighting Fixture

First Suffix	Second Suffix	Description
A		Rated for metal halide lamp
B		Rated for high pressure sodium lamp
	1	IES type II medium light distribution
2	IES type III medium light distribution	
	3	IES type V medium light distribution

Fixture shall conform to UL 1572. Fixture housing shall have sides and doorframe of one-piece extruded aluminum with welded joints and top of crowned sheet aluminum. The top shall be spot welded and sealed watertight. The housing shall be rigidly attached to a square shaped mounting arm of extruded aluminum. The fixture door shall have a flat heat and impact resistant lens of 3/16-inch nominal, tempered glass, and shall be hinged and held in place with captive screws of the same finish as the door. The lens and door shall enclose the lamp compartment. The reflector shall be aluminum of the manufacturer's standard commercial product finish suitable for the lamp type and rating. The ballast shall be of the high power factor type. The ballast and power components shall be mounted on a single bracket and shall be removable. The fixture, including the mounting arm, shall be gasketed to allow air movement but prevent the entry of dust and insects. Ballast shall be of the lead-peak autotransformer type for metal halide lamps, and regulating type for high pressure sodium lamps. Ballast shall be capable of starting and operating the lamp at ambient temperatures ranging from minus 20 degrees F to 105 degrees F. A square extruded aluminum pole including anchor type base, anchor bolts and mounting hardware shall be provided by the fixture manufacturer and shall be the manufacturer's standard commercial product for the number of fixtures and wind load indicated or specified. The fixture housing mounting arm shall have a dark duranodic bronze finish. The fixture shall be prewired and shall have a mogul base glazed porcelain lampholder. Fixture type indicated on this sheet shall also conform to requirements specified and indicated in the contract documents.

Corps of Engineers Department of the Army

TYPE 506 TYPE 507

Wall Bracket Mounting Slip Fitter Mounting

High Intensity Discharge Floodlight with Asymmetrical Light Distribution

First Suffix	Second Suffix	Third Suffix	Description
A			Rated for metal halide lamp
B			Rated for high pressure sodium (HPS) lamp
	1		NEMA type 6 x 5 light distribution
	2		NEMA type 7 x 7 light distribution
	3		NEMA type 7 x 6 light distribution
		A	Fixture with instant restrike feature
		B	Type 300 emergency unit

Fixture shall conform to UL 1572 and NEMA FA 1, and shall be the heavy-duty, enclosed type. Fixture shall consist of a cast aluminum housing and a cast aluminum door assembly and shall be integrally ballasted unless otherwise shown or approved. The door assembly shall be hinged and gasketed and held in a closed position with screws of finish to match fixture or recessed stainless steel latches. The lens shall be thermal shock and impact resistant tempered glass and shall be held securely in the door frame. Reflector shall be aluminum with manufacturer's standard commercial product finish suitable for light source provided. All metallic parts of the fixture shall receive one or more rust-inhibitive coatings prior to the application of interior and ex- terior finishes in accordance with the standard practice of the manufacturer for commercially available exterior lighting fixtures. Ballast shall be of the high power factor type capable of starting and operating the lamp in an ambient temperature of minus 20 degrees F to 105 degrees F. Ballast shall be of the lead-peak autotransformer type for metal halide lamps and the regulating type for high pressure sodium lamps. If an instant restrike feature is specified, the fixture shall be equipped to permit restarting of the lamp to full lumen output within 5 seconds following restoration of power after each momentary power interruption. The fixture shall be prewired and shall include a mogul base glazed porcelain lampholder. Mounting hardware for the fixture shall be adjustable, and shall be the cast aluminum type unless otherwise approved. Fixture type indicated on this sheet shall also conform to requirements specified and indicated in the contract documents.

***** SAFETY PAYS *****

SECTION 16670

LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL 16670-1
1.1 REFERENCES 16670-1
1.2 GENERAL REQUIREMENTS 16670-1
1.3 SUBMITTALS 16670-2

PART 2 PRODUCTS 16670-2
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SECTION 16670

LIGHTNING PROTECTION SYSTEM

12/88

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

FEDERAL SPECIFICATION (FS)

FS W-S-610	(Rev E) Splice Connectors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996) National Electrical Code
NFPA 780	(1992) Lightning Protection Code

UNDERWRITERS LABORATORIES (UL)

UL-03	(1992) Electrical Construction Materials Directory
UL 96	(1985; Rev thru Dec 1988) Lightning Protection Components
UL 96A	(1982; Rev thru Jul 1990) Installation Requirements for Lightning Protection Systems
UL 467	(1984; Rev thru Nov 1986) Grounding and Bonding Equipment
UL 486A	(1991; R Oct 91) Wire Connectors and Soldering Lugs for Use with Copper Conductors

1.2 GENERAL REQUIREMENTS

1.2.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work. No departures shall be made without the prior approval of the Contracting Officer.

1.2.2 System Requirements

The system furnished under this specification shall consist of the standard products of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest UL approved design. The lightning protection system shall conform to NFPA 70 and NFPA 780, UL 96 and UL 96A, except where requirements in excess thereof are specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-04 Drawings

Lightning Protection System; GA.

Detail drawings consisting of a complete list of material, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instructions. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

SD-13 Certificates

Materials and Equipment; FIO.

Where material or equipment is specified to comply with requirements of UL, proof of such compliance. The label of or listing in UL-03 will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters Laboratories may be submitted. A letter of findings shall be submitted certifying UL inspection of lightning protection systems provided on buildings used for manufacturing, processing, handling or storing explosives, ammunition, or explosive ingredients.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 General Requirements

No combination of materials shall be used that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, conductors with protective coatings or oversize conductors shall be used. Where a mechanical hazard is involved, the conductor size shall be increased to compensate for the hazard or the conductors shall be protected by covering them with molding or tubing made of wood or nonmagnetic material. When metallic conduit or tubing is used, the conductor shall be electrically connected at the upper and lower ends.

2.1.2 Main and Secondary Conductors

Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.

2.1.2.1 Copper

Copper conductors shall be as shown on drawings. Counterpoise shall be copper conductors not smaller than No. 1/0 AWG.

2.1.3 Air Terminals

Terminals shall be in accordance with UL 96 and NFPA 780.

2.1.4 Ground Rods

Rods made of copper-clad steel shall conform to UL 467. Ground rods shall be not less than 19 mm in diameter and 3.0 m in length. Ground rods of copper-clad steel, stainless steel, galvanized ferrous, and solid copper shall not be mixed on the job.

2.1.5 Clamp-Type Connectors

Connectors for splicing conductors shall conform to UL 96, class as applicable, and , Class 2, style and size as required for the installation.

2.1.6 Lightning Protection Components

Lightning protection components, such as bonding plates, air terminal supports, chimney bands, clips, and fasteners shall conform to UL 96, classes as applicable.

PART 3 EXECUTION

3.1 INTEGRAL SYSTEM

3.1.1 General Requirements

The lightning protection system shall consist of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

3.1.1.1 Air Terminals

Air terminal design and support shall be in accordance with NFPA 780. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 600 mm from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 600 mm in height on ridges, parapets, and around the perimeter of buildings with flat roofs shall not exceed 7.5 meters. In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than 50 mm for each 300 mm of increase over 7.5 meters. On large, flat or gently sloping roofs, as defined in NFPA 780, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding 15 m in length. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, smokestacks, and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed, air terminals shall be mounted thereon, where practicable. Any air terminal erected by necessity

adjacent to a metal ventilator shall be bonded to the ventilator near the top and bottom thereof. Where nonmetallic spires, steeples, or ventilators are present, air terminals shall be mounted thereon or to the side. In addition, where spires or steeples project more than 3.0 m above the building, the conductor between the air terminal and metal roof shall be continued to the nearest down conductor and securely connected thereto.

3.1.1.2 Roof Conductors

Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 200 mm. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 900 mm along the roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat surfaces, and flat roofs shall be connected to form a closed loop.

3.1.1.3 Down Conductors

Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two down conductors located as widely separated as practicable, at diagonally opposite corners. On rectangular structures having gable, hip, or gambrel roofs more than 35 m long, there shall be at least one additional down conductor for each additional 15 m of length or fraction thereof. On rectangular structures having French, flat, or sawtooth roofs exceeding 75 m in perimeter, there shall be at least one additional down conductor for each 30 m of perimeter or fraction thereof. On an L- or T-shaped structure, there shall be at least one additional down conductor; on an H-shaped structure, at least two additional down conductors; and on a wing-built structure, at least one additional down conductor for each wing. On irregularly shaped structures, the total number of down conductors shall be sufficient to make the average distance between them along the perimeter not greater than 30 meters. On structures exceeding 15 m in height, there shall be at least one additional down conductor for each additional 18 m of height or fraction thereof, except that this application will not cause down conductors to be placed about the perimeter of the structure at intervals of less than 15 meters. Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors ending at air terminals, except where the air terminal is on a roof below the main protected level and the "dead end" or branch conductor is less than 5 m in length and maintains a horizontal or downward coursing. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. Down conductors shall be protected where necessary, to prevent mechanical injury to the conductor.

3.1.1.4 Interconnection of Metallic Parts

All metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

3.1.1.5 Ground Connections

Ground connections comprising continuations of down conductors from the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor.

Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

3.1.1.6 Grounding Electrodes

A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than 3.0 meters. Ground rods shall be set not less than 900 mm nor more than 2.5 m from the structures foundation. The complete installation shall have a total resistance to ground of not more than 25 ohms. Ground rods shall be tested individually prior to connection to the system and the system as a whole shall be tested not less than 48 hours after rainfall. When the resistance of the complete installation exceeds the specified value or two ground rods individually exceed 25 ohms, the Contracting Officer will be notified immediately. A counterpoise shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 762 mm deep at a distance not less than 900 mm nor more than 2.5 m from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous. Where so indicated on the drawings, an alternate method for grounding electrodes in shallow soil shall be provided by digging trenches radially from the building. The lower ends of the down conductors or their equivalent in the form of metal strips or wires are then buried in the trenches.

3.1.2 Metal Roofs

Wood-Frame, Wall-Bearing Masonry or Tile Structure with Metallic Roof and Nonmetallic Exterior Walls, or Reinforced Concrete Building with Metallic Roof: Metal roofs which are in the form of sections insulated from each other shall be made electrically continuous by bonding. Air terminals shall be connected to, and made electrically continuous with, the metal roof as well as the roof conductors and down conductors. Ridge cables and roof conductors shall be bonded to the roof at the upper and lower edges of the roof and at intervals not to exceed 30 meters. The down conductors shall be bonded to roof conductors and to the lower edge of the metal roof. Where the metal of the roof is in small sections, the air terminals and down conductors shall have connections made to at least four of the sections. All connections shall have electrical continuity and have a surface contact of at least 1935 square millimeters.

3.1.3 Metal Roofs With Metal Walls

Wood-Frame Building With Metal Roof and Metal Exterior Walls: The metal roof and the metal walls shall be bonded and made electrically continuous and considered as one unit. The air terminals shall be connected to and made electrically continuous with the metal roof as well as the roof and down conductors. All connections shall have electrical continuity and have a surface contact of at least 1935 square millimeters.

3.1.4 Steel Frame Building

The steel framework shall be made electrically continuous. Electrical continuity may be provided by bolting, riveting, or welding steel frame, unless a specific method is noted on the drawings. The air terminals shall be connected to the structural steel framework at the ridge. Short runs of conductors shall be used as necessary to join air terminals to the metal framework so that proper placing of air terminals is maintained. Separate down conductors from air terminals to ground connections are not required. Where a grounded metal pipe water system enters the building, the structural steel framework and the water system shall be connected at the point

of entrance by a ground connector. Connections to pipes shall be by means of ground clamps with lugs. Connections to structural framework shall be by means of nut and bolt or welding. All connections between columns and ground connections shall be made at the bottom of the steel columns. Ground connections to grounding electrons or counterpoise shall be run from not less than one-half of all the columns distributed equally around the perimeter of the structure at intervals averaging not more than 18 meters.

3.1.5 Ramps

Lightning protection for covered ramps (connecting passageways) shall conform to the requirements for lightning protection systems for buildings of similar construction, as hereinbefore described. A down conductor and a driven ground shall be placed at one of the corners where the ramp connects to each building or structure. This down conductor and driven ground shall be connected to the counterpoise or nearest ground connection of the building or structure. Where buildings or structures and connecting ramps are clad with metal, the metal of the buildings or structures and metal of the ramp shall be connected in a manner to ensure electrical continuity, in order to avoid the possibility of a flash-over or spark due to a difference in potential.

3.4 INTERCONNECTION OF METAL BODIES

Metal bodies of conductance shall be protected if not within the zone of protection of an air terminal. All metal bodies of conductance having an area of 0.258 square meters or greater or a volume of 0.0164 cubic meters or greater shall be bonded to the lightning protection system using main size conductors and a bonding plate having a surface contact area of not less than 1935.5 square millimeters. Provisions shall be made to guard against the corrosive effect of bonding dissimilar metals. Metal bodies of inductance shall be bonded at their closest point to the lightning protection system using secondary bonding conductors and fittings. A metal body that exceeds 1.5 m in any dimension, that is situated wholly within a building, and that does not at any point come within 1.8 m of a lightning conductor or metal connected thereto shall be independently grounded.

3.5 FENCES

Except as indicated below, metal fences that are electrically continuous with metal posts extending at least 600 mm into the ground require no additional grounding. Other fences shall be grounded on each side of every gate. Fences shall be grounded by means of ground rods every 300 to 450 m of length when fences are located in isolated places, and every 150 to 225 m when in proximity (30m) to public roads, highways, and buildings. Where the fence consists of wooden posts and horizontal metal strands only, down conductors consisting of No. 8 copper wire or equivalent shall be run from the ground rod the full height of the fence and fastened to each wire, so as to be electrically continuous. The connection to ground shall be made from the post where it is of metal and is electrically continuous with the fencing. All metal fences shall be grounded at or near points crossed by overhead lines in excess of 600 volts and at distances not exceeding 45 m on each side of line crossings.

3.9 INSPECTION

The lightning protection system will be inspected by the Contracting Officer to determine conformance with the requirements of this specification. No part of the system shall be concealed until so authorized by the Contracting Officer.

--END OF SECTION--

***** SAFETY PAYS *****

SECTION 16710

PREMISES DISTRIBUTION SYSTEM

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SECTION 16710

PREMISES DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ELECTRONIC INDUSTRIES ASSOCIATION/ TELECOMMUNICATIONS INDUSTRYASSOCIATION (EIA/TIA)

TIA/EIA 568-A	(1995) Commercial Building Telecommunications Wiring Standard
EIA/TIA 569	(1990) Commercial Building Standard for Telecommunications Pathways and Spaces
EIA/TIA 606	(1993) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
EIA/TIA 607	(1994) Grounding and Bonding Requirements for the Telecommunications Infrastructure of Commercial Buildings
EIA/TIA TSB 36	Cable Specifications and Standards
EIA/TIA TSB 67	(DRAFT) Transmission Performance Specifications for Field Testing of UTP Cabling Systems

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-80-576	(1994) Communications Wire and Cable for Wiring of Premises
ICEA S-83-596	(1988) Fiber Optic Premises Distribution Cable

INTERNATIONAL BUSINESS MACHINES CORPORATION (IBM)

IBM GA27-3361-07	(1987) IBM Cabling System - Planning and Installation
IBM GA27-3773-1	(1987) IBM Cabling System Technical Interface Specification

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996) National Electrical Code

UNDERWRITERS LABORATORY (UL)

UL 50	(1992; Rev thru Nov 1994) Enclosures for Electrical

Equipment

1.2 SYSTEM DESCRIPTION

The premises distribution system shall consist of inside-plant horizontal, riser, and backbone cables with associated connecting hardware to transport telephone and data (including LAN) signals between equipment items in a building.

1.3 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 0 degree C to 60 degrees C and in the range of 0 percent to 95 percent relative humidity, non-condensing.

1.4 MINIMUM CONTRACTOR AND MANUFACTURERS QUALIFICATIONS

1.4.1 Certification

All work under this section shall be performed by and all equipment shall be furnished and installed by a certified telecommunications contractor, hereafter referred to as the Contractor. With the exception of furnishing and installing conduit, electrical boxes, and pullwires, this work shall not be done by the electrical contractor. The Contractor shall have the following qualifications in Telecommunications Systems installation:

a. Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.

b. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products. General electrical trade staff (electricians) shall not be used for the installation of the premises distribution system cables and associated hardware.

c. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.4.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract will be from manufacturers that have a minimum of 3 years experience in producing the types of systems and equipment specified.

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-01 Data

Spare Parts; FIO.

Lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of detail drawings, but not later than 2 months prior to the date of beneficial occupancy. The data shall

recommended for stocking.

SD-04 Drawings

Detail drawings including a complete list of equipment and material. Detail drawings shall contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated

elevation drawings of telecommunications closet walls, outlet faceplate details for all outlet configurations, sizes and types of all cables, conduits, and cable trays. Drawings shall show proposed layout and anchorage of

maintenance and operation. System drawings and records showing final configuration, including location, type, block, panel and terminal assignment of cabling in accordance with EIA/TIA 606, and floor plan layout of the

SD-06 Instructions

Manufacturers' Recommendations; GA.

the manufacturer of the material being installed, printed copies of these recommendations, prior to installation shall be provided. Installation of the item will not be allowed to proceed until the recommendations are received

SD-08 Statements

Test Plan; GA.

specifications, 60 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for

Qualifications; GA.

The qualifications of the Manufacturer(s), Contractor(s), and the Installer(s) to perform the work specified herein.

SD-09 Reports

Test Reports; FIO.

on 89 mm (3-1/2 inch) diskettes in MSWord 6.0 format. Reports shall show the field tests performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters

SD-13 Certificates

Premises Distribution System; GA.
Written certification that the premises distribution system fully complies with the TIA/EIA 568-A and EIA/TIA 606 standards.

Materials and Equipment; GA.

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, the Contractor shall submit certification that the items provided conform to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

Installers; GA.

The Contractor shall submit certification that all the installers are factory certified to install and test the provided products.

SD-19 Operation and Maintenance Manuals

Manufacturer's Manuals; FIO.

Commercial off the shelf manuals for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants.

1.7 OPERATION AND MAINTENANCE MANUALS

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

1.8 RECORD KEEPING AND DOCUMENTATION

1.8.1 Cables

A record of all installed cable shall be provided in hard copy format per EIA ANSI/TIA/EIA-606. The cable records shall include only the required data fields per EIA ANSI/TIA/EIA-606.

1.8.2 Termination Hardware

A record of all installed patch panels and outlets shall be provided in hard copy format per EIA ANSI/TIA/EIA-606. The hardware records shall include only the required data fields per EIA ANSI/TIA/EIA-606.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.

2.2 UNSHIELDED TWISTED PAIR CABLE SYSTEM

2.2.1 Cable Insulation

For each individual Category 5 cable, the insulation, material used on each pair shall be exactly the same in all physical, electrical, and chemical respects. The use of Teflon insulated, plenum rated Category 5 cable is acceptable for both plenum and non-plenum applications. If Teflon insulated plenum rated cable is used by the Contractor, it shall be Type 4x0, where all four pairs are Teflon insulated. Type 3x1 and 2x2 are not acceptable.

2.2.2 Riser Cable

Riser cable shall meet the requirements of ICEA S-80-576 and TIA/EIA 568-A for Category 5, 100-ohm unshielded twisted pair cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Conductors shall be solid untinned copper 24 AWG. Cable shall be rated CMR or CMP, as appropriate per NFPA 70.

2.2.3 Horizontal Cable

Horizontal cable shall meet the requirements of TIA/EIA 568-A for Category 5 horizontal cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Conductors shall be solid untinned copper 24 AWG. Cable shall be rated CMP or CMG, as appropriate, per NFPA 70.

2.2.4 Connecting Hardware

Connecting and cross-connecting hardware shall be the same category as the cable it serves. Hardware shall be in accordance with TIA/EIA 568-A.

2.2.4.1 Telecommunications Outlets

Administrative area outlet plates shall come equipped with two modular jacks, with the top or left jack labeled "Voice" and the bottom or right jack labeled "Data" and two blank panels for future fiber optic type connectors. Wall phone outlet plates shall come equipped with one unlabeled modular jack and appropriate mounting lugs. Modular jacks shall be the same category as the cable they terminate and shall meet the requirements of TIA/EIA 568-A. Modular jack pin/pair configuration shall be T568A per TIA/EIA 568-A. Modular jacks shall be unkeyed as shown. Single gang and double gang faceplates shall be provided and shall be ivory in color, impact resistant plastic. Outlet assemblies used in the premises distribution system shall consist of modular jacks assembled into both simplex and duplex outlet assemblies as specified in this section and as indicated on the drawings. The modular jacks shall conform to the requirements of TIA/EIA 568-A, Category 5.

2.2.4.2 Patch Panels

Patch panels shall consist of eight-position modular jacks, with rear mounted type 110 insulation displacement

connectors, arranged in rows or columns on 480 mm rack mounted panels. Jack pin/pair configuration shall be

2.2.4.3 Patch Cords

Patch cords shall be cable assemblies consisting of flexible, twisted pair stranded copper wire with eight-position

indicating verifying organization and performance level. Patch cords shall be wired straight through; pin numbers shall be identical at each end and shall be paired to match T568A patch panel jack wiring per TIA/EIA 568-A.

2.2.4.4 Terminal Blocks

Terminal blocks shall be wall mounted wire termination units consisting of insulation displacement connectors

568-A for category 5. Blocks shall be mounted on standoffs and shall include cable management hardware. Insulation displacement connectors shall be plated, shall terminate 24 gauge solid copper wire as a minimum, and

terminals.

2.3 COAXIAL CATV CABLE SYSTEM

CATV horizontal distribution cable shall meet the requirements of RG-59/U coaxial cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and

2.3.2 Connectors

Connectors shall be "F-Type." CATV cable faceplates shall be provided and shall be ivory in color, impact

system furniture and shall match the furniture system in color. Cable shall be rated CMG or CMP, as appropriate, per NFPA 70.

2.4.1 Backbone Cable

2.4.1.1 Multimode

62.5/125 micrometer (62.5/125 :m) multimode graded index optical fiber cable. Numerical aperture for each fiber shall be a minimum of 0.275. Cable construction shall be tight buffered type with two fiber strands. Individual

length at regular intervals of (1 meter). Cable shall be rated and marked OFNP or OFNG, as appropriate, per NFPA 70.

2.4.2.1 Connectors

Connectors shall be ST type ceramic ferrule material with a maximum insertion loss of .5 dB. Connectors shall meet performance requirements of TIA/EIA 568-A. Connectors shall be field installable. Connectors shall utilize adhesive for fiber attachment to ferrule. Connectors shall terminate fiber sizes as required for the service.

2.4.2.2 Patch Panels

Patch panels shall be a complete system of components by a single manufacturer, and shall provide termination, splice storage, routing, radius limiting, cable fastening, storage, and cross-connection. Patch panels shall be 480 mm rack mounted panels. Patch panels shall provide strain relief for cables. Panels shall be labeled with alphanumeric x-y coordinates. Patch panel connectors and couplers shall be the same type and configuration as used elsewhere in the system.

2.4.2.3 Patch Cords

Patch cords shall be cable assemblies consisting of flexible optical fiber cable with connectors of the same type as used elsewhere in the system. Optical fiber shall be the same type as used elsewhere in the system. Patch cords shall be complete assemblies from manufacturer's standard product lines.

2.5 EQUIPMENT RACKS

2.5.1 Floor Mounted Open Frame

Floor mounted equipment racks shall be aluminum relay racks with uprights to mount equipment 480 mm wide. Uprights shall be 75 mm (3 inch) deep channel, 32 mm (1-1/4 inches) wide, drilled and tapped 12-24 in a 13 mm (1/2 inch) pattern. Racks shall be provided with a standard top crossmember, and pre-drilled base plate to allow floor fastening. Open frame equipment racks shall be 2.1 m 7 feet in height. One (1) quad AC outlets shall be provided as shown.

2.5.2 Cable Guides

Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 480 mm wide equipment racks. Cable guides shall consist of ring or bracket-like devices mounted on rack panels for horizontal use or individually mounted for vertical use. Cable guides shall mount to racks by screws and/or nuts and lock-washers.

2.5.3 Wall Mounted Cabinets

Wall mounted NEMA boxes shall conform to UL 50 and constructed of zinc-coated sheet steel with dimensions not less than shown on drawings. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum openings to the box interiors. Boxes shall be provided with 19 mm plywood backboard painted white or a light color.

2.6 EQUIPMENT MOUNTING BACKBOARD

Plywood backboards shall be provided, 4' X 8' x 3/4" sized, per telephone equipment room, as shown, painted with white or light colored fire-resistant paint.

2.7 TELECOMMUNICATIONS OUTLET BOXES

Electrical boxes for telecommunication outlets shall be 117 mm4-11/16 inch square by 53 mm 2-1/8 inches deep with minimum 9 mm 3/8 inch deep single or two gang plaster ring. Provide a minimum 25 mm conduit.

PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions, and as shown. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Components shall be labeled in accordance with EIA/TIA 606. Penetrations in fire-rated construction shall be fire-stopped in accordance with Section 07270FIRESTOPPING. Conduits, outlets and raceways shall be installed in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Wiring shall be installed in accordance with TIA/EIA 568-A and as specified in Section 16415ELECTRICAL WORK, INTERIOR. TIA/EIA 568-A, Appendix C, or an approved alternative, shall be considered mandatory. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with AC power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance.

3.1.1 Horizontal Distribution Cable

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Fiber optic cables shall be provided with continuous support along its placement path avoiding point stress loads and shall be installed either in conduit or through type cable trays to prevent microbending losses. Copper cable, not in a wireway, shall be suspended a minimum of 200 mm above ceilings by cable supports no greater than 1.5 m apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 300 mm 12 inches shall be maintained when such placement cannot be avoided. Cables shall be terminated; no cable shall contain unterminated elements. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered.

3.1.2 Riser and Backbone Cable

Vertical cable support intervals shall be per manufacturers recommendations. Cable bend radius shall not be less than ten times the outside diameter of the cable during installation and once installed. Maximum tensile strength rating of the cable shall not be exceeded. Cable shall not be spliced.

3.1.3 Telecommunications Outlets
3.1.3.1 Faceplates

As a minimum, each jack shall be labeled as to its function and a unique number to identify cable link.

3.1.3.2 Cables

Unshielded twisted pair shall have a minimum of 150 mm 6 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturers bend radius for each type of cable shall not be exceeded.

3.1.3.3 Pull Cords

Pull cords shall be installed in all conduit serving telecommunications outlets which do not initially have fiber

optic cable installed.

3.1.4 Terminal Blocks

Terminal blocks shall be mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Industry standard wire routing guides shall be utilized.

3.1.5 Unshielded Twisted Pair Patch Panels

Patch panels shall be mounted in equipment racks with sufficient modular jacks to accommodate the installed cable plant plus 10 percent spares. Cable guides shall be provided above, below and between each panel.

3.1.6 Fiber Optic Patch Panels

Patch panels shall be mounted in equipment racks with sufficient ports to accommodate the installed cable plant plus 10 percent spares. A slack loop of fiber shall be provided within each panel. Loop shall be 900 mm and provide as recommended by the manufacturer. The outer jacket of each cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

3.1.7 Equipment Racks and Cabinets

Open frame equipment racks shall be bolted to the floor. Cable guides shall be bolted or screwed to racks. Racks shall be installed level. Ganged racks shall be bolted together. Ganged cabinets shall have adjacent side panels removed. Wall mounted racks shall be secured to the mounting surface to prevent fully loaded racks from separating from the mounting surface.

3.1.8 Rack Mounted Equipment

Equipment to be rack mounted shall be securely fastened to racks by means of the manufacturer's recommended fasteners.

3.2 TERMINATION

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. When there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.

3.2.1 Unshielded Twisted Pair Cable

Each pair shall be terminated on appropriate outlets, terminal blocks or patch panels. No cable shall be unterminated or contain unterminated elements. Pairs shall remain twisted together to within the proper distance from the termination as specified in TIA/EIA 568-A. Conductors shall not be damaged when removing insulation. Wire insulation shall not be damaged when removing outer jacket.

3.2.2 Coaxial Cable

Home run type station cables shall be terminated at each end. Backbone cables shall be terminated with appropriate connectors or end-of-line terminators as required. Loop-type cable systems shall be terminated with

appropriate drop connectors and terminators as required. Backbone cable shield conductor shall be grounded to communications ground at only one point and shall not make electrical contact with ground anywhere else.

3.2.3 Fiber Optic Cable

Each fiber shall have connectors installed. The pull strength between the connector and the attached fiber shall be not less than 1.3 kg. The mated pair loss, without rotational optimization, shall not exceed 1.0 dB. Fiber optic connectors shall be installed per TIA/EIA 568-A.

3.3 GROUNDING

Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunications closet in accordance with EIA/TIA 607 and Section 16415 ELECTRICAL WORK, INTERIOR. Equipment racks shall be connected to the electrical safety ground.

3.4 ADDITIONAL MATERIALS

The Contractor shall provide the following additional materials required for facility startup.

a. 10 of each type outlet.

b. 10 of each type cover plate.

c. 1 of each type terminal block for each telecommunications closet.

d. 4 Patch cords of 3 m 10 feet for each telecommunications closet.

e. 1 Set of any and all special tools required to establish a cross connect and to change and/or maintain a terminal block.

3.5 ADMINISTRATION AND LABELING

3.5.1 Labeling

3.5.1.1 Labels

All labels shall be in accordance with EIA ANSI/TIA/EIA-606.

3.5.1.2 Cable

All cables will be labeled using color labels on both ends with identifiers per EIA ANSI/TIA/EIA-606.

3.5.1.3 Termination Hardware

All workstation outlets and patch panel connections will be labeled using color coded labels with identifiers per EIA ANSI/TIA/EIA-606.

3.6 TESTING

Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required

inspections and tests have been made, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

3.6.1 Unshielded Twisted Pair Tests

All metallic cable pairs shall be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals shall be corrected. Correct color coding and termination of each pair shall be verified in the communications closet and at the outlet. Horizontal wiring shall be tested from and including the termination device in the communications closet to and including the modular jack in each room. Backbone wiring shall be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective communications closets. These tests shall be completed and all errors corrected before any other tests are started.

3.6.2 Category 5 Circuits

All category 5 circuits shall be tested using a test set that meets the Class II accuracy requirements of EIA/TIA TSB 67 (Draft) standard. Testing shall use the Basic Link Test procedures of EIA/TIA TSB 67. Cables which contain failed circuits shall be replaced and retested to verify the standard is met.

3.6.3 Coaxial Cable

Cable shall be tested for continuity, shorts and opens. Characteristic impedance shall be verified over the range of intended operation. Cable length shall be verified. Cable shall be sweep tested for attenuation over the range of intended operation.

3.6.4 Fiber Optic Cable

Unless stated otherwise, tests shall be performed from both ends of each circuit. Connectors shall be visually inspected for scratches, pits or chips and shall be re-terminated if any of these conditions exist. Each circuit leg and complete circuit shall be tested for insertion loss at 850 nm and 1300 nm using a light source similar to that used for the intended communications equipment. High-resolution optical time domain reflectometer (OTDR) tests shall be performed from one end of each fiber. Scale of the OTDR trace shall be such that the entire circuit appears over a minimum of eighty percent (80%) of the X-axis.

--END OF SECTION--

*** SAFETY PAYS ***

SECTION 16711

TELEPHONE SYSTEM, OUTSIDE PLANT

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*** SAFETY PAYS ***

SECTION 16711

TELEPHONE SYSTEM, OUTSIDE PLANT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 228	(1993) Steel Wire, Music Spring Quality
ASTM C 338	(1993) Softening Point of Glass
ASTM D 2239	(1994) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)
TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

EIA/TIA 455-25B	(1996) FOTP-25 Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies
EIA/TIA 455-41A	(1993) FOTP-41 Compressive Loading Resistance of Fiber Optic Cables
EIA/TIA 455-46A	(1990) FOTP-46 Spectral Attenuation Measurement for Long-Length, Graded-Index Optical Fibers
EIA/TIA 455-47B	(1992) FOTP-47 Output Far Field Radiation Pattern Measurement
EIA/TIA 455-51A	(1991) FOTP-51 Pulse Distortion Measurement of Multimode Glass Optical Fiber Information Transmission Capacity
EIA/TIA 455-53A	(1990) FOTP-53 Attenuation by Substitution Measurement for Multimode Graded-Index Optical Fibers or Fiber Assemblies Used in Long Length Communications Systems
EIA/TIA 455-54A	(1990) FOTP-54 Mode Scrambler Requirements for Overfilled Launching Conditions to Multimode Fibers
EIA 455-65	(1988) FOTP-65 Optical Fiber Flexure Test
EIA 455-81A	(1992) FOTP-81 Compound Flow (Drip) Test for Filled Fiber Optic Cable

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-56-434	(1983; R 1991) Polyolefin Insulated Communication

Cables for Outdoor Use

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996) National Electrical Code

RURAL ELECTRIFICATION ADMINISTRATION (REA)

REA Bulletin 1755I-100	(1991; Rev thru Supple 10) List of Materials Acceptable for Use on Telephone Systems of REA Borrowers
REA Form 522	(1993) General Specification for Digital, Stored Program Controlled Central Office Equipment
REA PC-2	(1995) Splicing Plastic-Insulated Cables
REA PC-4	(1976) Acceptance Tests and Measurements of Telephone Plant
REA PE-22	(1982) Aerial and Underground Telephone Cable
REA PE-33	(1985) Shield Bonding Connectors
REA PE-39	(1987) Filled Telephone Cables
REA PE-60	(1979) Trunk Carrier Systems
REA PE-74	(1985) Filled Splice Closures
REA PE-87	(1994) Terminating (TIP) Cable
REA PE-89	(1993) Filled Telephone Cables with Expanded Insulation
REA TE&CM 635	(1988; Addenda 1 thru 4) Construction of Aerial Cable Plant
REA TE&CM 641	(1973) Construction of Buried Plant
REA TE&CM 644	(1983) Design and Construction of Underground Cable (Physical Plant)
REA TE&CM 823 Arrestors	(1980) Electrical Protection by Use of Gas Tube

UNDERWRITERS LABORATORIES (UL)

UL 497 (1995; Rev May 1996) Protectors for Paired Conductor Communication Circuits

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-01 Data

Spare Parts; FIO.

Data lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of the detail drawings and not later than 3 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Telephone System; FIO.

Detail drawings consisting of a complete list of equipment and material including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts and installation instructions. Detail drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the cable system has been coordinated and will properly support the switching and transmission systems identified in the specification and drawings. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operations. System drawings showing final configuration, including the location, gauge, pair, duct and innerduct arrangement, or conductor assignment of outside plant, and protector and connector blocks layout at the termination points after installation.

SD-08 Statements

Test Plans; GA.

Test plans shall define all tests required to ensure that the system meets the specified requirements. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

SD-09 Reports

Acceptance Tests; FIO.

Test reports in booklet form showing all field tests performed, upon completion and testing of the installed system.

Installation Procedures; GA.

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations, prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

SD-13 Certificates

Telephone System; FIO.

Proof that the items furnished under this section conform to the specified requirements in FCC, ICEA, REA, RUS, ANSI, ASTM, NFPA, EIA, or UL, where materials and equipment are so specified.

Qualifications; GA.

The qualifications of the manufacturer, splicer, and installation supervisor as specified.

1.3 DELIVERY AND STORAGE

All cable shall be shipped on reels. The diameter of the drum shall be at least 13 times the diameter of the cable. The reels shall be substantial and so constructed as to prevent damage during shipment and handling. The outer end of the cable shall be securely fastened to the reel head so as to prevent the cable from becoming loose in transit. The inner end of the cable shall project into a slot in the side of the reel, or into a housing on the inner slot of the drum, in such a manner and with sufficient length to make it available for testing. The inner end shall be fastened so as to prevent the cable from becoming loose during installation. End seals shall be applied to each of the cables to prevent moisture from entering the cable. The reels with cable shall be suitable for outside storage conditions when the temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from 0 to 100 percent (0% to 100%). Equipment, other than cable, delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 2 years prior to bid opening. Each major component of equipment shall have the manufacturer's name and type identified on the equipment.

2.2 CABLE

2.2.1 Copper Conductor Cable

Copper conductor cable shall conform to the following:

2.2.1.1 Underground

REA PE-39 for cable smaller than 400 pair, and REA PE-39 or REA PE-89 for cable 400 pair or larger.

2.2.1.2 Screened

Screened cable shall comply with REA PE-89.

2.2.2 Fiber Optic Cable

Reeled fiber optic cable shall contain 60, 24 or 12 fibers, as appropriate for specific location shown on drawings, and shall be of continuous manufacture with no factory splices in the fiber.

2.2.2.1 Compatible Components

Materials used within a given cable shall be compatible with all other materials used in the same cable when such materials come into intimate contact. All cable components used shall have no adverse affect on optical transmission or on the mechanical integrity characteristics of the fiber placed in the cable. All materials used shall be non-toxic, non-corrosive, and shall present no dermal hazard. The minimum required material components applied to fiber optic cable construction are central core, color-coded optical fibers, inner jacket, pulling strength members, and outer jacket.

2.2.2.2 Cable Cores

A central core member shall be included to serve as a cable core foundation to reduce strain on the fibers but not to serve as a pulling strength member. The material of the central core member shall be nonmetallic. The sheath strength member shall be nonmetallic. The nonmetallic strength element shall be glass filament.

2.2.2.3 Optical Fiber

Singlemode optical fibers shall be contained in the cable. The singlemode fiber shall be step index optical glass. The core diameter, if an addressable parameter, shall be 8.5 microns plus or minus 2 microns. If the core diameter is not addressed, then the mode field diameter shall be 10 microns plus or minus 1 micron. The cladding diameter shall be 125 microns plus or minus 5 microns. The core-cladding offset shall be less than 1 micron. The minimum tensile strength of the fiber after primary protective coating shall be greater than The softening point of the clad material of the optical fiber shall be 1630 degrees C plus or minus 50 degrees C in compliance with ASTM C 338.

2.2.2.4 Optical Fiber Coatings

The optical fiber shall be coated with a suitable material to preserve the intrinsic high tensile strength of the glass fiber. The outside diameter of the coated optical fiber shall be 250 microns plus or minus 15 microns. The coating material shall be readily removable, mechanically or chemically, without damaging the optical fibers when the removal is desired.

2.2.2.5 Color Coding

The primary protective coated fiber shall be coated with a color-code coating for individual fiber identification. The maximum outside diameter of color-code coated fiber shall be less than 300 microns.

2.2.2.6 Fiber Protection

The color-code coated fibers shall be surrounded with either loose buffer tubes, channels or other innovative design, or in a tight buffer construction, for protection from external mechanical and environmental influences. The interior of the tube shall be filled with a suitable gel-filling compound to prevent water migration. The loose tube buffering, channel or other innovative design, or tight buffer construction, shall be color coded for the tube identification. The material of the buffering tube shall be PVC, mylar, nylon, or a functionally equivalent material.

2.2.2.7 Tint Requirements

The color concentrates or tints used to color the optical fibers and the buffer tubes shall not be susceptible to migration and chemical reaction with gel-filling compound.

2.2.2.8 Buffer Tubes

The buffer tubes shall be located concentrically around the cable central core member and covered with a black, low or medium density polyethylene inner jacket in accordance with ICEA S-56-434.

2.2.2.9 Filling Compound Requirements

The inner jacket interior and buffer cavity shall contain a gel-type filling compound. The filling compound shall be of suitable viscosity so that it shall protect the optical fibers against the ingress of water and/or soluble chemicals and shall not flow at the temperature of up to 65 degrees C. The gel-filling compound shall be colorless, electrically nonconducting, inert gel-type, waterproof, nontoxic, with no dermal hazards, and compatible chemically and mechanically with all cable components and associated splice hardware materials to which it may make contact. The gel-filling shall be removable, as required, using commercially available products under field conditions.

2.2.2.10 Tensile Strength

The cable shall contain a nonconductive central strength member as a well as a layer of aramid type yarn encircling the cable core. The strength member shall provide a maximum pulling load of 1335 Newtons.

2.2.2.11 Outer Jacket

Black, low or medium density, high-molecular weight, polyethylene materials shall be applied longitudinally over all the inner jacket and sheathing strength member to form the cable outer jacket, in accordance with ICEA S-56-434. The outer jacket shall be smooth, concentric, non-nutrient to fungus, and free from holes, splits, blisters, or other imperfections. The overall outside cable diameter shall not exceed 19.1 mm.

2.2.2.12 Armor Shield

A metallic armor shield shall be provided for additional tensile strength, rodent protection, and high crush and moisture resistance. The material of the metallic armoring shall be metallic tube or steel corrugation, coated with anti-corrosion material, and sealed at the longitudinal overlap.

2.2.2.13 Fiber Differentiation

The individual optical fiber shall be easily and positively identified from the buffer tube color code and the optical fiber primary coating color code.

2.2.2.14 Cable Labeling

The outer jacket shall bear the manufacturer's name, year of manufacture, and length marker. The length marking shall employ continuous four- or five-digit number in meters, such as:

Manufacturer's Name - Year
XXXX meter
The markings shall be repeated clearly and distinguishably, on every meter on the cable outer jacket. The marking ink shall be fully compatible with the jacket material, nonsmearing, nonwater soluble, abrasion resistant, and durable enough to withstand field handling during placement and subsequent operations.

2.2.2.15 Attenuation

The optical attenuation of each optical fiber in the reeled cable shall be no greater than 1.0 dB/km within a peak emissive region of 1300 nm. The attenuation shall be measured on completed cable reel length, and normalized linearly to 1 km. The measurement method shall be in accordance with EIA/TIA 455-46A or EIA/TIA 455-53A.

2.2.2.16 Bandwidth

Each optic fiber within the cable (reeled) shall have its bandwidth measured between 3 dB optical power points, as compared to a reference signal, for a light source with a peak optical emissive region of 1300 nm. The effective system bandwidth of at least 1 GHz-km is required. The effective system bandwidth is the bandwidth length product calculated from the measured bandwidth multiplied by the cable length raised to the negative length dependence factor (or gamma factor). Gamma shall be in the range of 0.85 to 0.9. The bandwidth measurement shall be in accordance with EIA/TIA 455-54A FOTP-30 frequency domain or EIA/TIA 455-51Atime domain.

2.2.2.17 Numerical Aperture

The numerical aperture of each optical fiber shall be 0.2 plus or minus 0.02 within an optical emissive region of 1300 nm. The method of numerical aperture measurement shall be in accordance with EIA/TIA 455-47A.

2.2.2.18 Bending Tolerance

The cable shall be able to withstand bending to a minimum radius of ten times the cable outer diameter with no tensile load applied, and of twenty times the cable outer diameter with maximum tensile load applied during installation, without damage to cable components or degradation of the optical fiber performance at room temperature.

2.2.2.19 Tensile Load Tolerance

The fiber optic cable shall withstand a pull force of at least 1780 Newtons, to be applied to the pulling strength member during the installation and a tensile load of at least 300 Newtons during operation without incurring any damage or detriment to fiber optic cable and optical performance. The tensile strength test shall be per EIA/TIA 455-54AFOTP-33.

2.2.2.20 Cyclic Flexing Tolerance

The fiber optic cable shall withstand at least twenty bending cycles at minimum bend radius without damage to the fiber optic cable components or degrading optical performance. The cyclic flexing test shall be in accordance with EIA/TIA 455-65.

2.2.2.21 Crush Resistance

The minimum crush resistance of the fiber optical cable shall be greater than 650 Newton/cm without damage to cable components or degrading optical performance. The crush resistance test shall be in accordance with EIA/TIA 455-41.

2.2.2.22 Impact Resistance

The fiber optic cable shall be capable of withstanding twenty impacts, at a force of 5 Newtons-meters, without damage to cable components, or degradation of optical performance. The impact resistance test shall be in accordance with EIA/TIA 455-25A FOTP-25.

2.2.2.23 Gel Compound Temperature Tolerance

The optic cable shall be tested for the ability of the gel-filling compound in the interior of the inner jacket and buffer to resist flow at the temperature range of minus 40 degrees C to 60 degrees C in accordance with EIA/TIA 455-81A.

2.2.2.24 Fluid Penetration Test

The optic cable shall be capable of preventing the entry and axial migration of 62 kPa pressurized water when subjected to fluid penetration testing in accordance with EIA/TIA 455-54A FOTP-82.

2.2.2.25 Performance Requirements

The fiber optic cable shall comply with the mechanical performance requirements herein while used in duct applications where the temperature varies minus 20 degrees C to plus 60 degrees C. Optical performance degradation shall be less than 5 percent of the optical performance requirements in the temperature range of minus 20 degrees C to plus 60 degrees C. The fiber optic cable shall not be damaged in storage where the temperature may vary from minus 40 degrees C to plus 65 degrees C.

2.2.2.26 Defects and Imperfections

Fiber optic cables shall be free of material and manufacturing defects, and of dimensional non-uniformities which would seriously impair the functionality of the cables. The fiber optic cables shall also be free from surface imperfections and internal defects, which would prevent them from meeting the mechanical and transmission requirements of this specification.

2.3 CONDUIT

Conduit as specified in Section 16415 ELECTRICAL WORK, INTERIOR and Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and as shown shall be furnished.

2.4 INNERDUCT

Innerduct shall be SIDR 11.5 polyethylene plastic pipe conforming to ASTM D 2239.

2.5 CLOSURES

2.5.1 Copper Conductor Closures

2.5.1.1 Underground

The underground closure shall be suitable to house a straight, butt, and branch splice in a protective housing into which can be poured an encapsulating compound. The closure shall be of stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. The encapsulating compound shall be re-enterable and shall not alter the chemical stability of the closure. Filled splice cases shall comply with REA PE-74.

2.5.2 Fiber Optic Closures

2.5.2.1 Underground

The underground closure shall be suitable to house a splicer organizer in a protective housing into which can be poured an encapsulating compound. The closure shall be stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. The encapsulating compound shall be re-enterable and shall not alter the chemical stability of the closure.

2.6 CABLE SPLICES, CONNECTORS, CABLE ASSEMBLIES, AND ORGANIZERS

2.6.1 Copper Cable Splices

Copper cable splices shall consist of a moisture resistant, two- or three-wire connector held rigidly in place to assure maximum continuity. The correct connector size shall be used to accommodate the cable gauge of the cable to be supplied. The connectors used shall be listed in REA Bulletin 1755I-100.

2.6.2 Fiber Optic Cable Splices

Fiber optic cable splices shall consist of a fusion splice where two fibers are thermally fused together forming a continuous fiber length.

2.6.3 Pre-Connectorized Single-Fiber Cable Assembly

Fiber cable connectors shall be the biconical type, field installable, self-aligning, and self-centering. The connectors shall be terminated on a 10-foot length of single-fiber cable. The single-fiber cable shall contain a buffered optical fiber of the same type and specification as that used in the multi-fiber cable.

2.6.4 Fiber Optic Splice Organizer

The splice organizer shall be suitable for housing fiber optic fusion splices in a neat and orderly fashion. The closure shall allow for a minimum of one meter of cable to be neatly stored without kinks or twists. The splice organizer in the closure shall provide individual strain relief for each splice. The case shall be suitable for reentry, if required for future maintenance or modification, without damage to the cable or splices. All required splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors shall be provided in the organizer kit.

2.7 MISCELLANEOUS ITEMS

2.7.1 Shield Connectors

Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar, or wire. The connector shall be made of tin-plated tempered brass. Shield bond connectors shall comply with REA PE-33.

2.7.2 Grounding Braid

Grounding braid shall provide low electrical impedance connections for dependable shield bonding. The braid shall be made from flat tin-plated copper.

2.7.3 Cable Warning Tape

Cable warning tape shall be a minimum of 75 mm wide, orange in color, and suitable for buried applications. The warning tape shall be continuously imprinted with the words "WARNING - COMMUNICATIONS CABLE BELOW" at not more than 1.2 mintervals.

2.7.4 Cable Warning Sign

Cable warning sign shall consist of one stake mounted warning sign. The stake shall be driven into undisturbed soil and the sign shall be mounted to the stake in accordance with the manufacturer's instructions.

PART 3 EXECUTION

3.1 INSTALLATION

All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and as shown. All necessary interconnections, services, and adjustments required for a complete and operable telephone system shall be provided. All installation work must be done in accordance with the safety requirements set forth in the general requirements of ANSI C2 and NFPA 70.

3.1.1 Buried Cable

3.1.1.1 Cable Installation

Buried cable installation shall be accomplished in accordance with the requirements set forth in REA TE&CM 641.

3.1.1.2 Cable Inspection and Repair

All buried cable and wire used in the construction of the project shall be handled with care. Each reel shall be inspected for cuts, nicks or other damage. All damage shall be repaired to the satisfaction of the Contracting Officer. The reel wrap shall remain intact on the reel until the cable or wire is ready to be placed.

3.1.1.3 Cable Laying

Cable laying operations shall commence at a switching location advancing outward without any breaks to the end of the leads.

3.1.1.4 Cable Depth

Cables shall be placed at a minimum depth of 750 mm. A 75 mm wide plastic warning tape shall be placed approximately 450 mm above the cables and not less than 150 mm from ground level.

3.1.1.5 Above Ground Cable Protection

Cable installed on the outside of buildings within reach of the ground or on the ground outside the buildings and generally accessible to any person, shall be in a protective cover, properly installed with appropriate fittings, bushings, and clamps.

3.1.1.6 Telephone Cable Bends

Telephone cable bends shall have a radius of not less than 10 times the cable diameter.

3.1.1.7 Penetrations

Penetrations in walls, ceilings or other parts of the building, made to provide for cable access, shall be caulked and sealed. All building entries shall be underground through waterproof facilities.

3.1.1.8 Cable Conduit for Traffic Areas

Where direct buried cable will pass under sidewalks, roads or other paved areas, the cable shall be placed in minimum 80 mm rigid galvanized steel conduit. Conduit may be installed by jacking or trenching. When direct buried cable is to be subject to damage from heavy equipment, the cable shall be placed in minimum 25 mm rigid

PVC conduit, a minimum of 1.1 m below the surface. Trenches shall be back-filled with earth and mechanically tamped at 150 mm lifts so that the earth is restored to the same grade as adjacent undisturbed material.

3.1.1.9 Trench-fill and Backfill for Rocky Soil

When placing cable in a trench in rocky soil, the cable shall be cushioned by a fill of sand or selected soil at least 50 mm thick on the floor of the trench before placing the cable or wire. The backfill for at least 100 mm above the wire or cable shall be free from stones, rocks, or other hard or sharp materials which might damage the cable or wire. If the buried cable is placed less than 600 mm in depth, a protective cover of metal or concrete shall be used.

3.1.2 Underground Cable

Underground cable installation shall be accomplished in accordance with the requirements set forth in REA TE&CM 644.

For cable installed in ducts and conduit, a cable feeder guide shall be used between the cable reel, and the face of the duct and conduit to protect the cable and guide it into the duct and conduit as it is payed off the reel. As the cable is payed off the reel, it shall be inspected for jacket defects. Precautions shall be taken during installation to prevent the cable from being kinked or crushed. A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. Cable shall be hand fed and guided through each manhole. As the cable is payed off the reel into the cable feeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. Where the cable is pulled through a manhole, additional lubricant shall be applied at all intermediate manholes. Dynamometers or load-tension instruments shall be used to ensure that the pulling line tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed upon a cable during installation shall not be such that the cable is twisted or stretched.

3.1.3 Innerduct

Innerduct shall be pulled through existing duct-manhole system in continuous sections. Splices, joints, couplings, or connections of any type will not be allowed between manholes and handholes. Innerduct shall be sealed with polyurethane foam duct seal. This material shall be inserted between the innerduct and the duct. In those innerducts in which cables are placed this material shall also be inserted between the cable and the innerduct. Only one cable shall be installed in a given innerduct. Existing and new unoccupied innerducts shall be trimmed leaving 50 mm exposed.

3.1.4 Surge Protection

All cables and conductors, except fiber optic cable, which serve as communication lines through off-premise lines, shall have surge protection installed at each end which meet the requirements of REA PE-60.

3.2 SPLICING

3.2.1 Copper Conductor Splices

Copper conductor cable splicing shall be accomplished in accordance with REA PC-2.

3.2.2 Fiber Optic Splices

Fiber optic splicing shall be in accordance with the manufacturer's recommendation and shall exhibit an insertion loss not greater than 0.2 dB for fusion splices.

3.3 GROUNDING

Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals shall be grounded.

3.3.1 Master Ground Bar (MGB)

The Contractor shall provide a copper MGB which shall be the hub of the basic grounding system providing a common point of connection for ground from outside cable, MDF, and equipment. The Contractor shall establish a MGB to ground resistance, including ground, of 5 ohms or less.

3.3.2 Incoming Outside Plant Cables

3.3.2.1 Cable Entrance Ground Bar

The Contractor shall provide a Cable Entrance Ground Bar (CEGB) to which all incoming outside plant cable shields shall be bonded directly. The CEGB shall be a copper ground bar provided for the purpose of terminating incoming telephone cable shields on a common connector point. The CEGB shall be connected to the MGB by the most direct route utilizing a copper wire conductor with a total resistance of less than 0.01 Ohms.

3.3.2.2 Main Distribution Frame Ground Bar

All shields of cable stubs to connector block shall be bonded to the Main Distribution Frame Ground Bar (MDFB). The MDFB shall be established by the Contractor and shall consist of a copper ground bar at the bottom of the MDF used as the connection point for the cable stub shields to connector blocks and MDF protector assemblies.

3.3.2.3 Shields

The shields of all incoming cables shall not be bonded across the splice to the cable stubs. The shields of the incoming cables shall be grounded in the vault.

3.3.3 Main Distribution Frame Grounding

3.3.3.1 Protection Assemblies

The MDF protector assemblies shall be mounted directly on the telephone terminal backboard. The assemblies mounted on each telephone terminal backboard shall be connected with a No. 6 AWG copper conductor to provide a low resistance path to the MDFB.

3.3.4 Manholes

The shields of all cables in each manhole shall be bonded together by a bonding wire or ribbon. At intermediate manholes where the cable is pulled through without a sheath opening, bonds are not required. If the manhole has a lacerating bonding ribbon, the shields of cable shall be attached to it.

3.3.5 Handholes

The shields of all cables in each handhole shall be bonded together by a bonding wire or ribbon. At intermediate handholes where the cable is pulled through without a sheath opening, bonds are not required. If the handhole has a lacerating bonding ribbon, the shields of cable shall be attached to it.

3.4 ACCEPTANCE TESTS

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test, and in no case shall notice be given until after the Contractor has received written Contracting Officer approval of the test plans as specified. The test plans shall define all the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

3.4.1 Copper Conductor Cable

The following acceptance tests shall be performed in accordance with REA PC-4:

a. Shield continuity.

b. Conductor continuity.

c. Conductor insulation resistance.

d. Structural return loss.

e. Cable insertion loss and loss margin at carrier frequencies.

f. Shield ground for single jacketed cables.

g. DC loop resistance.

3.4.2 Fiber Optic Cable

Three optical tests shall be performed: Optical Time Domain Reflectometry (OTDR) Test, Attenuation Test, and Bandwidth Test. These tests shall be performed on the completed end-to-end spans which include the near-end pre-connectorized single-fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single-fiber cable assembly. The following acceptance tests shall be performed for each fiber in the completed cable length. Singlemode fibers do not require Bandwidth Test

3.4.2.1 OTDR Test

The OTDR test shall be used to determine the adequacy of the cable installations. The OTDR tests will show any irregularities, such as discontinuities, micro-bendings, improper splices, for the cable span under test. Hardcopy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber, 1 km minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature.

3.4.2.2 Attenuation Test

End-to-end attenuation measurements shall be made on all fibers, in both directions, using a 1300 nanometer light source at one end and the optical power meter on the other end. These tests will be used to verify that the cable system attenuation requirements are met. The measurement method shall be in accordance with EIA/TIA 455-53A.

3.4.2.3 Bandwidth Test

The bandwidth shall be measured in both directions on all fibers. The bandwidth measurements shall be in accordance with EIA/TIA 455-54AFOTP-30.

--END OF SECTION--

*** SAFETY PAYS ***

SECTION 16711

TELEPHONE SYSTEM, OUTSIDE PLANT

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SECTION 16711

TELEPHONE SYSTEM, OUTSIDE PLANT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 228	(1993) Steel Wire, Music Spring Quality
ASTM C 338	(1993) Softening Point of Glass
ASTM D 2239	(1994) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)
TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

EIA/TIA 455-25B	(1996) FOTP-25 Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies
EIA/TIA 455-41A	(1993) FOTP-41 Compressive Loading Resistance of Fiber Optic Cables
EIA/TIA 455-46A	(1990) FOTP-46 Spectral Attenuation Measurement for Long-Length, Graded-Index Optical Fibers
EIA/TIA 455-47B	(1992) FOTP-47 Output Far Field Radiation Pattern Measurement
EIA/TIA 455-51A	(1991) FOTP-51 Pulse Distortion Measurement of Multimode Glass Optical Fiber Information Transmission Capacity
EIA/TIA 455-53A	(1990) FOTP-53 Attenuation by Substitution Measurement for Multimode Graded-Index Optical Fibers or Fiber Assemblies Used in Long Length Communications Systems
EIA/TIA 455-54A	(1990) FOTP-54 Mode Scrambler Requirements for Overfilled Launching Conditions to Multimode Fibers
EIA 455-65	(1988) FOTP-65 Optical Fiber Flexure Test
EIA 455-81A	(1992) FOTP-81 Compound Flow (Drip) Test for Filled Fiber Optic Cable

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-56-434	(1983; R 1991) Polyolefin Insulated Communication Cables for Outdoor Use

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996) National Electrical Code

RURAL ELECTRIFICATION ADMINISTRATION (REA)

REA Bulletin 1755I-100	(1991; Rev thru Supple 10) List of Materials Acceptable for Use on Telephone Systems of REA Borrowers
REA Form 522	(1993) General Specification for Digital, Stored Program Controlled Central Office Equipment
REA PC-2	(1995) Splicing Plastic-Insulated Cables
REA PC-4	(1976) Acceptance Tests and Measurements of Telephone Plant
REA PE-22	(1982) Aerial and Underground Telephone Cable
REA PE-33	(1985) Shield Bonding Connectors
REA PE-39	(1987) Filled Telephone Cables
REA PE-60	(1979) Trunk Carrier Systems
REA PE-74	(1985) Filled Splice Closures
REA PE-87	(1994) Terminating (TIP) Cable
REA PE-89	(1993) Filled Telephone Cables with Expanded Insulation
REA TE&CM 635	(1988; Addenda 1 thru 4) Construction of Aerial Cable Plant
REA TE&CM 641	(1973) Construction of Buried Plant
REA TE&CM 644	(1983) Design and Construction of Underground Cable (Physical Plant)
REA TE&CM 823 Arrestors	(1980) Electrical Protection by Use of Gas Tube

UNDERWRITERS LABORATORIES (UL)

UL 497	(1995; Rev May 1996) Protectors for Paired Conductor Communication Circuits

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-01 Data

Spare Parts; FIO.

Data lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of the detail drawings and not later than 3 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Telephone System; FIO.

Detail drawings consisting of a complete list of equipment and material including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts and installation instructions. Detail drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the cable system has been coordinated and will properly support the switching and transmission systems identified in the specification and drawings. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operations. System drawings showing final configuration, including the location, gauge, pair, duct and innerduct arrangement, or conductor assignment of outside plant, and protector and connector blocks layout at the termination points after installation.

SD-08 Statements

Test Plans; GA.

Test plans shall define all tests required to ensure that the system meets the specified requirements. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

SD-09 Reports

Acceptance Tests; FIO.

Test reports in booklet form showing all field tests performed, upon completion and testing of the installed system.

Installation Procedures; GA.

***** SAFETY PAYS *****

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations, prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

SD-13 Certificates

Telephone System; FIO.

Proof that the items furnished under this section conform to the specified requirements in FCC, ICEA, REA, RUS, ANSI, ASTM, NFPA, EIA, or UL, where materials and equipment are so specified.

Qualifications; GA.

The qualifications of the manufacturer, splicer, and installation supervisor as specified.

1.3 DELIVERY AND STORAGE

All cable shall be shipped on reels. The diameter of the drum shall be at least 13 times the diameter of the cable. The reels shall be substantial and so constructed as to prevent damage during shipment and handling. The outer end of the cable shall be securely fastened to the reel head so as to prevent the cable from becoming loose in transit. The inner end of the cable shall project into a slot in the side of the reel, or into a housing on the inner slot of the drum, in such a manner and with sufficient length to make it available for testing. The inner end shall be fastened so as to prevent the cable from becoming loose during installation. End seals shall be applied to each of the cables to prevent moisture from entering the cable. The reels with cable shall be suitable for outside storage conditions when the temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from 0 to 100 percent (0% to 100%). Equipment, other than cable, delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 2 years prior to bid opening. Each major component of equipment shall have the manufacturer's name and type identified on the equipment.

2.2 CABLE

2.2.1 Copper Conductor Cable

Copper conductor cable shall conform to the following:

2.2.1.1 Underground

REA PE-39 for cable smaller than 400 pair, and REA PE-39 or REA PE-89 for cable 400 pair or larger.

2.2.1.2 Screened

Screened cable shall comply with REA PE-89.

2.2.2 Fiber Optic Cable

Reeled fiber optic cable shall contain 60, 24 or 12 fibers, as appropriate for specific location shown on drawings, and shall be of continuous manufacture with no factory splices in the fiber.

2.2.2.1 Compatible Components

Materials used within a given cable shall be compatible with all other materials used in the same cable when such materials come into intimate contact. All cable components used shall have no adverse affect on optical transmission or on the mechanical integrity characteristics of the fiber placed in the cable. All materials used shall be non-toxic, non-corrosive, and shall present no dermal hazard. The minimum required material components applied to fiber optic cable construction are central core, color-coded optical fibers, inner jacket, pulling strength members, and outer jacket.

2.2.2.2 Cable Cores

A central core member shall be included to serve as a cable core foundation to reduce strain on the fibers but not to serve as a pulling strength member. The material of the central core member shall be nonmetallic. The sheath strength member shall be nonmetallic. The nonmetallic strength element shall be glass filament.

2.2.2.3 Optical Fiber

Singlemode optical fibers shall be contained in the cable. The singlemode fiber shall be step index optical glass. The core diameter, if an addressable parameter, shall be 8.5 microns plus or minus 2 microns. If the core diameter is not addressed, then the mode field diameter shall be 10 microns plus or minus 1 micron. The cladding diameter shall be 125 microns plus or minus 5 microns. The core-cladding offset shall be less than 1 micron. The minimum tensile strength of the fiber after primary protective coating shall be greater than The softening point of the clad material of the optical fiber shall be 1630 degrees C plus or minus 50 degrees C in compliance with ASTM C 338.

2.2.2.4 Optical Fiber Coatings

The optical fiber shall be coated with a suitable material to preserve the intrinsic high tensile strength of the glass fiber. The outside diameter of the coated optical fiber shall be 250 microns plus or minus 15 microns. The coating material shall be readily removable, mechanically or chemically, without damaging the optical fibers when the removal is desired.

2.2.2.5 Color Coding

The primary protective coated fiber shall be coated with a color-code coating for individual fiber identification. The maximum outside diameter of color-code coated fiber shall be less than 300 microns.

2.2.2.6 Fiber Protection

The color-code coated fibers shall be surrounded with either loose buffer tubes, channels or other innovative design, or in a tight buffer construction, for protection from external mechanical and environmental influences. The interior of the tube shall be filled with a suitable gel-filling compound to prevent water migration. The loose tube buffering, channel or other innovative design, or tight buffer construction, shall be color coded for the

tube identification. The material of the buffering tube shall be PVC, mylar, nylon, or a functionally equivalent material.

2.2.2.7 Tint Requirements

The color concentrates or tints used to color the optical fibers and the buffer tubes shall not be susceptible to migration and chemical reaction with gel-filling compound.

2.2.2.8 Buffer Tubes

The buffer tubes shall be located concentrically around the cable central core member and covered with a black, low or medium density polyethylene inner jacket in accordance with ICEA S-56-434.

2.2.2.9 Filling Compound Requirements

The inner jacket interior and buffer cavity shall contain a gel-type filling compound. The filling compound shall be of suitable viscosity so that it shall protect the optical fibers against the ingress of water and/or soluble chemicals and shall not flow at the temperature of up to 65 degrees C. The gel-filling compound shall be colorless, electrically nonconducting, inert gel-type, waterproof, nontoxic, with no dermal hazards, and compatible chemically and mechanically with all cable components and associated splice hardware materials to which it may make contact. The gel-filling shall be removable, as required, using commercially available products under field conditions.

2.2.2.10 Tensile Strength

The cable shall contain a nonconductive central strength member as a well as a layer of aramid type yarn encircling the cable core. The strength member shall provide a maximum pulling load of 1335 Newtons.

2.2.2.11 Outer Jacket

Black, low or medium density, high-molecular weight, polyethylene materials shall be applied longitudinally over all the inner jacket and sheathing strength member to form the cable outer jacket, in accordance with ICEA S-56-434. The outer jacket shall be smooth, concentric, non-nutrient to fungus, and free from holes, splits, blisters, or other imperfections. The overall outside cable diameter shall not exceed 19.1 mm.

2.2.2.12 Armor Shield

A metallic armor shield shall be provided for additional tensile strength, rodent protection, and high crush and moisture resistance. The material of the metallic armoring shall be metallic tube or steel corrugation, coated with anti-corrosion material, and sealed at the longitudinal overlap.

2.2.2.13 Fiber Differentiation

The individual optical fiber shall be easily and positively identified from the buffer tube color code and the optical fiber primary coating color code.

2.2.2.14 Cable Labeling

The outer jacket shall bear the manufacturer's name, year of manufacture, and length marker. The length marking shall employ continuous four- or five-digit number in meters, such as:

Manufacturer's Name - Year
XXXX meter
The markings shall be repeated clearly and distinguishably, on every meter on the cable outer jacket. The marking ink shall be fully compatible with the jacket material, nonsmearing, nonwater soluble, abrasion resistant, and durable enough to withstand field handling during placement and subsequent operations.

2.2.2.15 Attenuation

The optical attenuation of each optical fiber in the reeled cable shall be no greater than 1.0 dB/km within a peak emissive region of 1300 nm. The attenuation shall be measured on completed cable reel length, and normalized linearly to 1 km. The measurement method shall be in accordance with EIA/TIA 455-46A or EIA/TIA 455-53A.

2.2.2.16 Bandwidth

Each optic fiber within the cable (reeled) shall have its bandwidth measured between 3 dB optical power points, as compared to a reference signal, for a light source with a peak optical emissive region of 1300 nm. The effective system bandwidth of at least 1 GHz-km is required. The effective system bandwidth is the bandwidth length product calculated from the measured bandwidth multiplied by the cable length raised to the negative length dependence factor (or gamma factor). Gamma shall be in the range of 0.85 to 0.9. The bandwidth measurement shall be in accordance with EIA/TIA 455-54A FOTP-30 frequency domain or EIA/TIA 455-51Atime domain.

2.2.2.17 Numerical Aperture

The numerical aperture of each optical fiber shall be 0.2 plus or minus 0.02 within an optical emissive region of 1300 nm. The method of numerical aperture measurement shall be in accordance with EIA/TIA 455-47A.

2.2.2.18 Bending Tolerance

The cable shall be able to withstand bending to a minimum radius of ten times the cable outer diameter with no tensile load applied, and of twenty times the cable outer diameter with maximum tensile load applied during installation, without damage to cable components or degradation of the optical fiber performance at room temperature.

2.2.2.19 Tensile Load Tolerance

The fiber optic cable shall withstand a pull force of at least 1780 Newtons, to be applied to the pulling strength member during the installation and a tensile load of at least 300 Newtons during operation without incurring any damage or detriment to fiber optic cable and optical performance. The tensile strength test shall be per EIA/TIA 455-54AFOTP-33.

2.2.2.20 Cyclic Flexing Tolerance

The fiber optic cable shall withstand at least twenty bending cycles at minimum bend radius without damage to the fiber optic cable components or degrading optical performance. The cyclic flexing test shall be in accordance with EIA/TIA 455-65.

2.2.2.21 Crush Resistance

The minimum crush resistance of the fiber optical cable shall be greater than 650 Newton/cm without damage to cable components or degrading optical performance. The crush resistance test shall be in accordance with EIA/TIA 455-41.

2.2.2.22 Impact Resistance

The fiber optic cable shall be capable of withstanding twenty impacts, at a force of 5 Newtons-meters, without damage to cable components, or degradation of optical performance. The impact resistance test shall be in accordance with EIA/TIA 455-25A FOTP-25.

2.2.2.23 Gel Compound Temperature Tolerance

The optic cable shall be tested for the ability of the gel-filling compound in the interior of the inner jacket and buffer to resist flow at the temperature range of minus 40 degrees C to 60 degrees C in accordance with EIA/TIA 455-81A.

2.2.2.24 Fluid Penetration Test

The optic cable shall be capable of preventing the entry and axial migration of 62 kPa pressurized water when subjected to fluid penetration testing in accordance with EIA/TIA 455-54A FOTP-82.

2.2.2.25 Performance Requirements

The fiber optic cable shall comply with the mechanical performance requirements herein while used in duct applications where the temperature varies minus 20 degrees C to plus 60 degrees C. Optical performance degradation shall be less than 5 percent of the optical performance requirements in the temperature range of minus 20 degrees C to plus 60 degrees C. The fiber optic cable shall not be damaged in storage where the temperature may vary from minus 40 degrees C to plus 65 degrees C.

2.2.2.26 Defects and Imperfections

Fiber optic cables shall be free of material and manufacturing defects, and of dimensional non-uniformities which would seriously impair the functionality of the cables. The fiber optic cables shall also be free from surface imperfections and internal defects, which would prevent them from meeting the mechanical and transmission requirements of this specification.

2.3 CONDUIT

Conduit as specified in Section 16415 ELECTRICAL WORK, INTERIOR and Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and as shown shall be furnished.

2.4 INNERDUCT

Innerduct shall be SIDR 11.5 polyethylene plastic pipe conforming to ASTM D 2239.

2.5 CLOSURES

2.5.1 Copper Conductor Closures

2.5.1.1 Underground

The underground closure shall be suitable to house a straight, butt, and branch splice in a protective housing into which can be poured an encapsulating compound. The closure shall be of stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. The encapsulating compound shall be re-enterable and shall not alter the chemical stability of the closure. Filled splice cases shall comply with REA PE-74.

2.5.2 Fiber Optic Closures

2.5.2.1 Underground

The underground closure shall be suitable to house a splicer organizer in a protective housing into which can be poured an encapsulating compound. The closure shall be stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. The encapsulating compound shall be re-enterable and shall not alter the chemical stability of the closure.

2.6 CABLE SPLICES, CONNECTORS, CABLE ASSEMBLIES, AND ORGANIZERS

2.6.1 Copper Cable Splices

Copper cable splices shall consist of a moisture resistant, two- or three-wire connector held rigidly in place to assure maximum continuity. The correct connector size shall be used to accommodate the cable gauge of the cable to be supplied. The connectors used shall be listed in REA Bulletin 1755I-100.

2.6.2 Fiber Optic Cable Splices

Fiber optic cable splices shall consist of a fusion splice where two fibers are thermally fused together forming a continuous fiber length.

2.6.3 Pre-Connectorized Single-Fiber Cable Assembly

Fiber cable connectors shall be the biconical type, field installable, self-aligning, and self-centering. The connectors shall be terminated on a 10-foot length of single-fiber cable. The single-fiber cable shall contain a buffered optical fiber of the same type and specification as that used in the multi-fiber cable.

2.6.4 Fiber Optic Splice Organizer

The splice organizer shall be suitable for housing fiber optic fusion splices in a neat and orderly fashion. The closure shall allow for a minimum of one meter of cable to be neatly stored without kinks or twists. The splice organizer in the closure shall provide individual strain relief for each splice. The case shall be suitable for reentry, if required for future maintenance or modification, without damage to the cable or splices. All required splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors shall be provided in the organizer kit.

2.7 MISCELLANEOUS ITEMS

2.7.1 Shield Connectors

Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar, or wire. The connector shall be made of tin-plated tempered brass. Shield bond connectors shall comply with REA PE-33.

2.7.2 Grounding Braid

Grounding braid shall provide low electrical impedance connections for dependable shield bonding. The braid shall be made from flat tin-plated copper.

2.7.3 Cable Warning Tape

Cable warning tape shall be a minimum of 75 mm wide, orange in color, and suitable for buried applications. The warning tape shall be continuously imprinted with the words "WARNING - COMMUNICATIONS CABLE BELOW" at not more than 1.2 mintervals.

2.7.4 Cable Warning Sign

Cable warning sign shall consist of one stake mounted warning sign. The stake shall be driven into undisturbed soil and the sign shall be mounted to the stake in accordance with the manufacturer's instructions.

PART 3 EXECUTION

3.1 INSTALLATION

All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and as shown. All necessary interconnections, services, and adjustments required for a complete and operable telephone system shall be provided. All installation work must be done in accordance with the safety requirements set forth in the general requirements of ANSI C2 and NFPA 70.

3.1.1 Buried Cable

3.1.1.1 Cable Installation

Buried cable installation shall be accomplished in accordance with the requirements set forth in REA TE&CM 641.

3.1.1.2 Cable Inspection and Repair

All buried cable and wire used in the construction of the project shall be handled with care. Each reel shall be inspected for cuts, nicks or other damage. All damage shall be repaired to the satisfaction of the Contracting Officer. The reel wrap shall remain intact on the reel until the cable or wire is ready to be placed.

3.1.1.3 Cable Laying

Cable laying operations shall commence at a switching location advancing outward without any breaks to the end of the leads.

3.1.1.4 Cable Depth

Cables shall be placed at a minimum depth of 750 mm. A 75 mm wide plastic warning tape shall be placed approximately 450 mm above the cables and not less than 150 mm from ground level.

3.1.1.5 Above Ground Cable Protection

Cable installed on the outside of buildings within reach of the ground or on the ground outside the buildings and generally accessible to any person, shall be in a protective cover, properly installed with appropriate fittings, bushings, and clamps.

3.1.1.6 Telephone Cable Bends

Telephone cable bends shall have a radius of not less than 10 times the cable diameter.

3.1.1.7 Penetrations

Penetrations in walls, ceilings or other parts of the building, made to provide for cable access, shall be caulked and sealed. All building entries shall be underground through waterproof facilities.

3.1.1.8 Cable Conduit for Traffic Areas

Where direct buried cable will pass under sidewalks, roads or other paved areas, the cable shall be placed in minimum 80 mm rigid galvanized steel conduit. Conduit may be installed by jacking or trenching. When direct buried cable is to be subject to damage from heavy equipment, the cable shall be placed in minimum 25 mm rigid PVC conduit, a minimum of 1.1 m below the surface. Trenches shall be back-filled with earth and mechanically tamped at 150 mm lifts so that the earth is restored to the same grade as adjacent undisturbed material.

3.1.1.9 Trench-fill and Backfill for Rocky Soil

When placing cable in a trench in rocky soil, the cable shall be cushioned by a fill of sand or selected soil at least 50 mm thick on the floor of the trench before placing the cable or wire. The backfill for at least 100 mm above the wire or cable shall be free from stones, rocks, or other hard or sharp materials which might damage the cable or wire. If the buried cable is placed less than 600 mm in depth, a protective cover of metal or concrete shall be used.

3.1.2 Underground Cable

Underground cable installation shall be accomplished in accordance with the requirements set forth in REA TE&CM 644.

For cable installed in ducts and conduit, a cable feeder guide shall be used between the cable reel, and the face of the duct and conduit to protect the cable and guide it into the duct and conduit as it is payed off the reel. As the cable is payed off the reel, it shall be inspected for jacket defects. Precautions shall be taken during installation to prevent the cable from being kinked or crushed. A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. Cable shall be hand fed and guided through each manhole. As the cable is payed off the reel into the cable feeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. Where the cable is pulled through a manhole, additional lubricant shall be applied at all intermediate manholes. Dynamometers or load-tension instruments shall be used to ensure that the pulling line tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed upon a cable during installation shall not be such that the cable is twisted or stretched.

3.1.3 Innerduct

***** SAFETY PAYS *****

Innerduct shall be pulled through existing duct-manhole system in continuous sections. Splices, joints, couplings, or connections of any type will not be allowed between manholes and handholes. Innerduct shall be sealed with polyurethane foam duct seal. This material shall be inserted between the innerduct and the duct. In those innerducts in which cables are placed this material shall also be inserted between the cable and the innerduct. Only one cable shall be installed in a given innerduct. Existing and new unoccupied innerducts shall be trimmed leaving 50 mm exposed.

3.1.4 Surge Protection

All cables and conductors, except fiber optic cable, which serve as communication lines through off-premise lines, shall have surge protection installed at each end which meet the requirements of REA PE-60.

3.2 SPLICING

3.2.1 Copper Conductor Splices

Copper conductor cable splicing shall be accomplished in accordance with REA PC-2.

3.2.2 Fiber Optic Splices

Fiber optic splicing shall be in accordance with the manufacturer's recommendation and shall exhibit an insertion loss not greater than 0.2 dB for fusion splices.

3.3 GROUNDING

Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals shall be grounded.

3.3.1 Master Ground Bar (MGB)

The Contractor shall provide a copper MGB which shall be the hub of the basic grounding system providing a common point of connection for ground from outside cable, MDF, and equipment. The Contractor shall establish a MGB to ground resistance, including ground, of 5 ohms or less.

3.3.2 Incoming Outside Plant Cables

3.3.2.1 Cable Entrance Ground Bar

The Contractor shall provide a Cable Entrance Ground Bar (CEGB) to which all incoming outside plant cable shields shall be bonded directly. The CEGB shall be a copper ground bar provided for the purpose of terminating incoming telephone cable shields on a common connector point. The CEGB shall be connected to the MGB by the most direct route utilizing a copper wire conductor with a total resistance of less than 0.01 Ohms.

3.3.2.2 Main Distribution Frame Ground Bar

All shields of cable stubs to connector block shall be bonded to the Main Distribution Frame Ground Bar (MDFB). The MDFB shall be established by the Contractor and shall consist of a copper ground bar at the bottom of the MDF used as the connection point for the cable stub shields to connector blocks and MDF protector assemblies.

3.3.2.3 Shields

The shields of all incoming cables shall not be bonded across the splice to the cable stubs. The shields of the incoming cables shall be grounded in the vault.

3.3.3 Main Distribution Frame Grounding

3.3.3.1 Protection Assemblies

The MDF protector assemblies shall be mounted directly on the telephone terminal backboard. The assemblies mounted on each telephone terminal backboard shall be connected with a No. 6 AWG copper conductor to provide a low resistance path to the MDFB.

3.3.4 Manholes

The shields of all cables in each manhole shall be bonded together by a bonding wire or ribbon. At intermediate manholes where the cable is pulled through without a sheath opening, bonds are not required. If the manhole has a lacerating bonding ribbon, the shields of cable shall be attached to it.

3.3.5 Handholes

The shields of all cables in each handhole shall be bonded together by a bonding wire or ribbon. At intermediate handholes where the cable is pulled through without a sheath opening, bonds are not required. If the handhole has a lacerating bonding ribbon, the shields of cable shall be attached to it.

3.4 ACCEPTANCE TESTS

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test, and in no case shall notice be given until after the Contractor has received written Contracting Officer approval of the test plans as specified. The test plans shall define all the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

3.4.1 Copper Conductor Cable

The following acceptance tests shall be performed in accordance with REA PC-4:

a. Shield continuity.

b. Conductor continuity.

c. Conductor insulation resistance.

d. Structural return loss.

e. Cable insertion loss and loss margin at carrier frequencies.

f. Shield ground for single jacketed cables.

g. DC loop resistance.

3.4.2 Fiber Optic Cable

Three optical tests shall be performed: Optical Time Domain Reflectometry (OTDR) Test, Attenuation Test, and Bandwidth Test. These tests shall be performed on the completed end-to-end spans which include the near-end pre-connectorized single-fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single-fiber cable assembly. The following acceptance tests shall be performed for each fiber in the completed cable length. Singlemode fibers do not require Bandwidth Test

3.4.2.1 OTDR Test

The OTDR test shall be used to determine the adequacy of the cable installations. The OTDR tests will show any irregularities, such as discontinuities, micro-bendings, improper splices, for the cable span under test. Hardcopy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber, 1 km minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature.

3.4.2.2 Attenuation Test

End-to-end attenuation measurements shall be made on all fibers, in both directions, using a 1300 nanometer light source at one end and the optical power meter on the other end. These tests will be used to verify that the cable system attenuation requirements are met. The measurement method shall be in accordance with EIA/TIA 455-53A.

3.4.2.3 Bandwidth Test

The bandwidth shall be measured in both directions on all fibers. The bandwidth measurements shall be in accordance with EIA/TIA 455-54AFOTP-30.

--END OF SECTION--

SUBMITTAL REGISTER (ER415-1-10)													CONTRACT NO.	
TITLE AND LOCATION				CONTRACTOR									SPEC. SECTION 16711	
					CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
ACT. NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SUBMITTAL DESCRIPTION, TYPE, CLASSIFICATION AND PARAGRAPH NUMBER d. through q.	REV-IEW-ER r.	SUBMIT s.	APPROV. NEEDED BY t.	MATER. NEEDED BY u.	CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	CODE y.	DATE z.	REMARKS aa.
			PAR. NO. 1.2 SUBMITTALS										
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			SD-04 Drawings										
		2	Telephone System; FIO.										
			SD-08 Statements										
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SECTION 16721

FIRE DETECTION AND ALARM SYSTEM

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SECTION 16721

FIRE DETECTION AND ALARM SYSTEM

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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991) Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996) National Electrical Code
NFPA 72	(1996) National Fire Alarm Code
NFPA 90A	(1993) Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL-04	(1994) Fire Protection Equipment Directory
UL 6	(1993) Rigid Metal Conduit
UL 38	(1994; Rev Jan 1994) Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems
UL 268	(1989; Rev May 1989) Smoke Detectors for Fire Protective Signaling Systems
UL 464	(1990) Audible Signal Appliances
UL 467	(1993) Grounding and Bonding Equipment
UL 521	(1993) Heat Detectors for Fire Protective Signaling Systems
UL 797	(1993) Electrical Metallic Tubing
UL 864	(1991; Rev thru May 1994) Control Units for Fire-Protective Signaling Systems
UL 1242	(1983; Rev thru Jul 1993) Intermediate Metal Conduit

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours.

1.2.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

1.2.3 Keys and Locks

Locks shall be keyed alike.

1.2.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

1.2.5 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.2.6 Compliance

The fire detection and internal alarm system and the central reporting system shall be configured in accordance with NFPA 72. The equipment furnished shall be compatible and be UL listed or FM approved or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

1.2.7 Manufacturer's Services

Services of a manufacturer's representative who is experienced in the installation, adjustment, testing, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

1.3 SYSTEM DESIGN

1.3.1 Operation

The fire alarm and detection system shall be a complete, supervised fire alarm system. The system shall be activated into the alarm mode by actuation of any alarm-initiating device. The system shall remain in the alarm mode until initiating device is reset and the fire alarm control panel is reset and restored to normal. The Fire Alarm Control Panel shall be fully compatible with the existing King-Fisher Industrial Radio Alarm Control System (IRACS) presently in use at Fort Campbell. The fire alarm AM transmitter shall be Government furnished, contractor installed. Alarm initiating devices shall be connected to signal line circuits (SLC), Style 6 in accordance with NFPA 72. Alarm indicating appliances shall be connected to indicating appliance circuits (IAC), Style Z in accordance with NFPA 72. A two-loop conduit system shall be provided so that if any one conduit and all conductors contained in that conduit is severed all IAC, or SLC on that circuit shall remain functional. A two-loop system is not applicable to the central fire alarm communication center from the local panels. All textual, audible, and visual appliances and systems shall comply with NFPA 72.

Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits.

a. Sufficient memory shall be provided to perform as specified and as shown for addressable system.
b. Individual identity of each addressable device shall be provided for the following conditions:

alarm
trouble
open
short
appliances missing/failed
remote detector - sensitivity adjustment from the panel for smoke detectors

c. All addressable devices shall have the capability of individually being disabled or enabled from the panel.

1.3.2 Operational Features

The system shall have the following operating features:

a. Electrical supervision of alarm SLC and IAC. Smoke detectors shall have combined alarm initiating and power circuits.

b. Electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.

c. Trouble buzzer and trouble lamp (light emitting diode or neon light) to activate upon a single break, open, or ground fault condition, which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator lamp. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

d. Transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but shall provide a trouble signal when disconnected and a restoration signal when reconnected.

e. Evacuation alarm silencing switch or switches which, when activated, will silence alarm devices, but will not affect the zone indicating lamp nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed zone and the alarm devices will be activated.

f. Electrical supervision of circuits used for supervisory signal services. Supervision shall detect any open, short, or ground.

g. Confirmation or verification modules used on smoke detection initiating circuits. The modules shall interrupt the transmission of an alarm signal to the system control panel for a factory set period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal if present will be sent immediately to the control panel. All fire alarm devices other than smoke detectors shall be prohibited on circuits controlled by confirmation or verification modules.

h. Zones for alarm SLC shall be arranged as indicated on the contract drawings.

1.3.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the following functions:

a. Transmission of signals over the station radio fire reporting system. The signal shall be different for each zone.

b. Visual indications of the alarmed zones on the fire alarm control panel annunciator.

c. Continuous sounding of alarm notification appliances throughout the building.

d. Deactivation of the air handling units throughout the building.

1.3.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

1.3.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FI0" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-01 Data

Battery; FIO.

Substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included.

Voltage Drop; FIO.

Voltage drop calculations for signaling appliance circuits to indicate that sufficient voltage is available for proper appliance operation.

Spare Parts; FIO.

Spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

Qualifications; FIO.

Qualifications, with verification of experience and license number, of a Registered Professional Engineer with at least 4 years of current experience in the design of the fire protection and detection systems. This engineer must perform the various specification items required by this section to be performed by a registered Professional Engineer.

SD-04 Drawings

Fire Alarm Reporting System; GA.

Detail drawings, signed by the Fire Protection Engineer, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit.

Detailed point-to-point wiring diagram signed by the Fire Protection Engineer, showing all points of connection. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and all equipment that is activated or controlled by the panel.

SD-06 Instructions

Fire Alarm Reporting System; GA.

Six copies of operating instructions outlining step-by-step procedures required for system startup, operation, and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The instructions shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. Instructions shall be approved prior to training.

Training; FIO.

Lesson plans and training data, in manual format, for the training courses.

SD-08 Statements

Test Procedures; FIO.

Detailed test procedures, signed by the Registered Professional Engineer, for the fire detection and alarm system 60 days prior to performing system tests.

SD-09 Reports

Testing; FIO.

Test reports in booklet form showing all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall document all readings, test results and indicate the final position of controls.

SD-13 Certificates

Equipment; FIO.

Certified copies of current approvals or listings issued by UL, FM or other nationally recognized testing laboratory, showing compliance with specified NFPA standards.

Installer; FIO.

Evidence that the installer of the system is listed in UL-04 under "Protective Signaling Services - Local, Auxiliary, Remote Station Proprietary (UUJS)".

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, and any other contaminants.

PART 2 PRODUCTS

2.1 CONTROL PANEL

The Fire Alarm Control Panel shall be fully compatible with the existing King-Fisher Industrial Radio Alarm Control System (IRACS) presently in use at Fort Campbell. Control Panel shall comply with all the applicable requirements of UL 864. Panel shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing all components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for all lamps, zones, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. Separate alarm and trouble lamp shall be provided for each zone alarm located on exterior of cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means shall be provided for testing the control panel visual indicating devices (meters or lamps). Meters and lamps shall be plainly visible when the cabinet door is closed. Signals shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Each SLC initiating circuit shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other zones. Loss of power, including any or all batteries, shall not require the reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals.

2.1.1 Visual Annunciators

Visual annunciators shall be provided for each active zone and spare zone. Two Spare zones shall be provided as shown on the drawing. Each lamp shall provide specific identification of the zone by means of a permanently attached rigid plastic, phenolic or metal sign with either raised or engraved letters. Zone identification shall consist of word description of the zone.

2.1.2 Cabinets

Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate all units. Cabinets shall have manufacturer’s standard finish and color.

2.1.3 Remote System Trouble Audible/Visual Appliance

Audible appliance shall have a minimum sound level output rating of 85 dBA at 3.048 m and operate in conjunction with the panel's integral trouble signal. The audible device shall be silenced by the system trouble silence switch. A rigid plastic, phenolic or metal identification sign which reads "Fire Alarm System Trouble" shall be provided at the audible appliance. The visual appliance located with the audible appliance shall not be extinguished until the trouble has been cleared.

2.1.4 Circuit Connections

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each terminal marked for identification.

2.2 STORAGE BATTERIES

Storage Batteries shall be provided and shall be the sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 48 hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 15 minutes. Batteries shall be sized to deliver 50 percent more ampere/hours based on a 48 hour discharged rate than required for the calculated capacities. Battery cabinet shall be a separate compartment within the control panel. Batteries in the control panel shall be located at the bottom of the panel. Battery shall be provided with overcurrent protection in accordance with NFPA 72.

2.3 BATTERY CHARGER

Battery charger shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 12 hours. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state of the battery charge. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly if a high rate switch is provided. Charger shall be located in control panel or battery cabinet.

2.4 MANUAL FIRE ALARM STATIONS

Manual fire alarm stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into alarm-initiating circuits. Stations shall be installed on surface mounted outlet boxes. Stations shall be single action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be painted the same color as the fire alarm manual stations. Addressable pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset.

2.5 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors shall be connected into alarm initiating circuits. Detectors located in concealed locations (above ceiling, etc.) shall have a remote visible indicator lamp. Installed devices shall conform to the classification of the area. Addressable fire detecting devices except flame detectors shall be dynamically supervised and uniquely identified in the control panel.

2.5.1 Heat Detectors

Heat detectors shall be designed for detection of fire by fixed temperature and combination fixed temperature and rate-of-rise principle. Heat detectors shall be rated for a minimum of 15.2 m spacing (smooth-ceiling rated) in accordance with UL 521. Detectors located in areas subject to moisture, exterior atmospheric conditions or hazardous locations as defined by NFPA 70, shall be types approved for such locations. Heat detectors located in attic spaces or similar concealed spaces below the roof shall be intermediate temperature rated.

2.5.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors shall be designed for semi-flush outlet box mounting and supported independently of wiring connections. Contacts shall be self-resetting after response to rate-of-rise principle. Under fixed temperature actuation, the detector shall have a permanent external indication which is readily visible. Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes shall operate on fixed temperature principle only. Rating for fixed temperature portion shall be 57.2 degrees C in temperature conditioned spaces.

2.5.1.3 Fixed Temperature Detectors

Detectors shall be designed for semi-flush outlet box mounting and supported independently of wiring connections. Detectors are designed to detect high heat. The detectors shall have a specific temperature setting 57.2 degrees C.

2.5.2 Smoke Detectors

Detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be ionization type. Detectors shall contain a visible indicator lamp that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making all wiring connections. Detectors that are in concealed (above false ceilings, etc.) locations shall have a remote visible indicator lamp.

2.5.2.1 Ionization Detectors (Soldier Community Building, Company Operations, Brigade Headquarters, and Battalion Headquarters)

Ionization detectors with a dual chamber shall be responsive to both invisible and visible particles of combustion. One chamber shall be a reference chamber and the second a sampling chamber. Detectors containing radium shall not be provided. Detectors shall not cause an alarm condition due to anticipated fluctuations in relative humidity. The sensitivity of the detector shall be field adjustable to compensate for operating conditions. Detector shall require no replacement or readjustment to restore it to normal operation after an alarm condition. Each detector shall be capable of withstanding ambient air velocity up to 1.5 meters per second in accordance with UL 268. Detectors shall have at least a two-stage sensitivity setting, with detectors initially set for normal sensitivity. A lower sensitivity shall be available for each detector. The lower sensitivity shall be within the limits established for that detector by UL or FM.

2.5.2.4 Duct Detectors

Photoelectric-type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Detector includes relay with auxiliary contacts as required for fan shutdown.

2.5.3 Single-Station (Barracks Room) Smoke Detectors

Detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be photoelectric type. Detectors shall be suitable for 120-Volt operation equipped with battery back-up. Contractor shall furnish the batteries. Detectors shall have a self-contained audible alarm that sounds when either connecting room detector is in alarm condition. Detectors shall not be adversely affected by vibration or pressure.

2.5.3.1 Photoelectric Detectors (Barracks Buildings)

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating between 1.9 and 2.4 percent per foot when tested in accordance with UL 268.

2.6 NOTIFICATION APPLIANCES

Audible appliances shall be heavy duty and conform to the applicable requirements of UL 464. Devices shall be connected into alarm indicating circuits and shall have a separate screw terminal for each conductor. All device shall be painted red similar to FED-STD 595color, number 11105.

2.6.1 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box surface mounted recessed grill and vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a minimum sound rating of at least 85 dBA at 3.048 m. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grills. All horns in an area shall be synchronized.

2.6.2 Visual Notification Appliances

Visual alarm indicating devices shall be 75, or 110 candela strobe lights producing between 60 and 120 flashes per minute. Strobe light shall include a red cast metal housing, a clear lexan lens with red "FIRE" lettering on at least two sides, and a xenon flash tube with solid state circuitry. Strobe light shall be UL listed or FM approved for fire protective service.

2.6.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements, as individual units except they shall mount as a unit in standard backboxes. All units shall be factory assembled. Any other audible indicating appliance employed in the fire alarm systems shall be approved by the authority having jurisdiction.

2.7 NOT USED

2.8 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.8.1 Ground Rods

Ground rods shall be of copper clad steel conforming to UL 467 not less than 15.9 mm in diameter by 2.4 m in length.

2.8.3 Conduit

Conduit and fittings shall comply with UL 6, UL 1242 and UL 797.

2.8.4 Wiring

Wiring for 120V ac power shall be No. 12 AWG minimum. Wiring for low voltage dc circuits shall be No. 16 AWG minimum. Power wiring (over 28 volts) and control wiring shall be isolated. All wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except rigid plastic conduit may be used under slab-on-grade. All conductors shall be color-coded. Conductors used for the same functions shall be similarly color-coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to alarm initiating, supervisory circuits, and alarm indicating circuits are prohibited. T-tapping using screw terminal blocks is allowed for addressable systems.

2.8.5 Special Tools and Spare Parts

Special tools necessary for the maintenance of the equipment shall be furnished. Two spare fuses of each type and size required and five spare lamps and LED's of each type shall be furnished. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Fuses and lamps shall be mounted in the fire alarm panel.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as shown and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until the building has been thoroughly cleaned.

3.1.1 Power Supply for the System

A single dedicated circuit connection for supplying power to each building fire alarm system shall be provided. The primary power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked "FIRE ALARM CIRCUIT CONTROL".

3.1.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. No more than one conductor shall be installed under any screw terminal. All circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be connected to screw terminals with each terminal marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors are prohibited in the system. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.1.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 300 mm nor more than 2 m above the finished floor. All manually operable controls shall be between 900 mm to 1.1 m above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.1.4 Detectors

Detectors shall be installed in accordance with NFPA 72. Detectors shall be at least 300 mm from any part of any lighting fixture. Detectors shall be located at least 900 mm from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors, which mount in free space, shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 900 mm, sway bracing shall be provided.

3.1.5 Notification Appliances

Notification appliances shall be mounted a minimum of 2.4 m above the finished floor unless limited by ceiling height or otherwise indicated.

3.1.6 Annunciator Equipment

Annunciator equipment provided shall be mounted where indicated.

3.2 OVERVOLTAGE AND SURGE PROTECTION

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 and NFPA 70. All cables and conductors, which serve as communications links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for surge protection.

3.3 GROUNDING

Grounding shall be provided to building ground or ground rods shall be driven. Maximum impedance to ground shall be 25 ohms. Ground rods shall not protrude more than 150 mm above grade.

3.4 TESTING

The Contractor shall notify the Contracting Officer 30 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise all tests. The Contractor shall furnish all instruments and personnel required for the tests.

3.4.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance. Tests shall include the meggering of all system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional.

3.4.2 Acceptance Test

Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that all previous deficiencies have been corrected. The test shall include the following:

a. Test of each function of the control panel.

b. Test of each circuit in both trouble and normal modes.

c. Tests of alarm initiating devices in both normal and trouble conditions.

d. Tests of each control circuit and device.

e. Tests of each alarm notification appliance.

f. Tests of the battery charger and batteries.

g. Complete operational tests under emergency power supply.

h. Visual inspection of all wiring connections.

i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.

j. Ground fault

k. Short circuit faults

l. Stray voltage

m. Loop resistance

3.5 TRAINING

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period shall consist of 3 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover all of the items contained in the operating and maintenance instructions.

--END OF SECTION--