DACA41-02-B-0002

US Army Corps of Engineers
Kansas City District
You Matter - We Care

Renovation of Riley's Building 446

Fort Riley, Kansas

This is an 8(a) procurement,
Competitive within Region VII.

Construction Solicitation and Specifications

July 2002

DEPARTMENT OF THE ARMY
Kansas City District, Corps of Engineers
757 Federal Building
Kansas City, Missouri 64106

SPECIFICATIONS FOR CONSTRUCTION OF
RENOVATION OF RILEY'S, BUILDING 446
FORT RILEY, KANSAS

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15650	Refrigeration Equipment (Compressors, Condensing Units, Chillers, Cooling Towers, Liquid Coolers, Condensers)
15850	Air Handling Equipment (Air Handling Units with Coils, Centrifugal Fans, Axial Fans, Power Ventilators)
15880	Air Distribution Equipment (Air Cleaning Devices, Ductwork, Ductwork Accessories, Air Terminal Units, Air Outlets and Inlets)
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SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair)	1. SOLICITATION NO.	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE OF	PAGES
	DACA41-02-B-0002	[X] SEALED BID (IFB) [ ] NEGOTIATED (RFP)	7/30/2002	1	32

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

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

7. ISSUED BY CODE	8. ADDRESS OFFER TO
U.S. Army Engineer District, Kansas City 760 Federal Building, 601 E. 12th Street Kansas City, Missouri 64106-2896 Tel: (816) 983-3845 Fax: (816) 426-5169	See Item 7 Bid Opening Room: 748

9. FOR INFORMATION CALL:	A. NAME	B. TELEPHONE NO. (Include area code)	
	Earl V. Smith	816-983-3846	Ext. (NO COLLECT CALLS)

SOLICITATION

NOTE: In sealed bid solicitation "offer" and "offeror" mean "bid" and "Bidder".

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

Renovation of Riley's, Building 446
Fort Riley, Kansas

Description of Work: The work to be performed consists of renovation of Riley's into a state-of-the-art conference center. Work includes mechanical, electrical, and information systems upgrades, as well as architectural and structural upgrades.

This is an 8(a) procurement, competitive within Region VII, and will be administered by Fort Riley.

11. The Contractor shall begin performance within 10 calendar days and complete it within ** calendar days after receiving [ ] award [X] notice to proceed. This performance period is [X] mandatory, [ ] negotiable. **See Section 00800)

12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? *(If "YES", indicate within how many calendar days after award in Item 12B.)*	12B. CALENDAR DAYS
[X] YES [ ] NO	10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and one copies to perform the work required are due at the place specified in Item 8 by 2:00 p.m. local time 8/29/2002 *(date).* If this is a sealed bid solicitation, offers will 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 [X] is, [ ] is not required. NOT TO EXCEED 20% OF TOTAL BID AMOUNT

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 120 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

NSN 7540-01-155-3212 1442 102 **STANDARD FORM 1442** (REV. 4-85)
Prescribed by GSA
FAR (48 CFR) 53.236-1(d)

DACA41-02-B-0002 **OFFER** *(Must be fully completed by offeror)*

14. NAME AND ADDRESS OF OFFEROR *(Include ZIP Code)*

15. TELEPHONE NO. *(Include area code)*

(FAX #)

16. REMITTANCE ADDRESS (Include only if different from Item 14)

DUNS NO:

CODE FACILITY CODE

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within _____ 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:	See attached Bidding Schedule

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

19. ACKNOWLEDGEMENT 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)* ITEM

25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO

26. ADMINISTERED BY CODE

☐ 10 U.S.C. 2304(c) ( ) ☐ 41 U.S.C. 253(c) ( )

27. PAYMENT WILL BE MADE BY

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 requirements identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contact shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications 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 of print)*

31A. NAME OF CONTRATING OFFICER *(Type or print)*

30B. SIGNATURE	31b. UNITED STATED OF AMERICA	31C. AWARD DATE

STANDARD FORM 1442 BACK (REV. 4-85)

SECTION 00010 Solicitation Contract Form

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0001		1.00	Lump Sum		

RENOVATION OF RILEY'S BUILDING 446, FT RILEY, KS.
FFP - The Contractor shall furnish all Plant, Labor, Equipment, Materials, and Transportation to perform all required work and services in accordance with the Plans and Specifications for the Renovation of Building 446 except for the installation of "Owner Supplied, Contractor Installed" food service equipment indicated on Sheets FS1.0 thru FS1.3 of the plans.

NET AMT

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0002		1.00	Lump Sum		

RENOVATION OF RILEY'S BUILDING 446, RILEY, KS.
FFP - The Contractor shall furnish all Plant, Labor, Equipment, Materials, and Transportation to perform all required work and services in accordance with the Plans and Specifications for the installation of "Owner Supplied, Contractor Installed" food service equipment indicated on Sheets FS1.0 thru FS1.3 of the plans.

NET AMT

TOTAL EXCLUDING OPTION _____ . _____

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0003		1.00	Each		

RENOVATION OF RILEY'S BUILDING 446, FT RILEY, KS.
FFP - The contractor shall furnish all Plant, Labor, Equipment, Materials, and Transportation to furnish one or more portable sound systems as specified in Paragraph 2.6.22, Section 16775, Audio Visual Systems, of the specifications. Each portable sound system shall be fully assembled, tested, and ready for use.

NET AMT

TOTAL INCLUDING OPTION _____ . _____

CLAUSES INCORPORATED BY FULL TEXT

FIELD OFFICE OVERHEAD

NOTICE TO BIDDERS: For your bid to be responsive, you must declare below the single accounting practice that you apply to contracts to calculate field office overhead for all change orders, modifications and requests for equitable adjustment. Pursuant to Federal Acquisition Regulations (FAR) Parts 31.105(d)(3) and 31.203(d)(1), an accounting practice that varies from modification to modification is not allowable. Select one of the following:

1. TIME DISTRIBUTION BASE FOR A PER DIEM RATE
   If you use this practice, see Special Clause "Field Office Overhead Per Diem Rate" _____

2. DIRECT COST DISTRUBITION BASE FOR A PERCENTAGE MARKUP
   If you use this practice, see Special Clause "Field Office Overhead Percentage Markup" _____

3. OTHER ACCOUNTING PRACTICE THAT IS ALLOWABLE UNDER THE FAR AND THAT USES A SINGLE DISTRIBUTION BASE. _____

IF YOUR CHIOCE IS NO. 3, YOU MUST DESCRIBE THE ACCOUNTING PRACTICE IN SUFFICIENT DETAIL BELOW TO ALLOW THE CONTRACTING OFFICER TO DETERMINE WHAT ACCOUNTING PRACTICE IS BEING UTILIZED BY YOUR COMPANY AND THAT IT COMPLIES WITH THE FAR.

_____

_____

_____

FAILURE TO FULLY COMPLY WITH THE ABOVE REQUIREMENT OR, IF ALTERNATIVE 3 IS DECLARED AND YOUR DESCRIPTION DOES NOT CLEARLY STATE OR DESCRIBE A CONSISTENT ACCOUNTING PRACTICE USING A SINGLE DISTRIBUTION BASE, WILL BE CAUSE FOR YOUR BID TO BE REJECTED AS NON-RESPONSIVE.

NOTES:

1) Bid prices must be entered for all items of the Bidding Schedule. Award will be made as a whole to one Contractor.

2) All quantities are estimated.

3) All extensions of the unit prices shown will be subject to verification by the Contracting Officer. In case of variation between the unit price and the extension, the unit price will be considered to be the bid.

4) If a modification to a bid is submitted that provides for a lump sum adjustment to the total cost, the application of the lump sum adjustment to each price in the Bidding Schedule must be stated. If it is not stated, the bidder agrees that the lump sum adjustment shall be applied on a pro rata basis to every price in the Bidding Schedule.

5) Bidder's attention is directed to SECTION 0100 paragraph titled "Arithmetic Discrepancies" wherein are procedures for correction of errors.

6) Bidder's attention is directed to CONTRACT CLAUSE titled "Contract Prices—Bidding Schedules."

7) Award will be made to the low responsible and responsible bidder. Bidder's attention is directed to SECTION 00100 paragraph entitled "Contract Award—Sealed Bidding—Construction" for further details.

8) Bidder's attention is directed to SECTION 01100: GENERAL for special provisions pertaining to this

9) Bidder's attention is directed to the CONTRACT CLAUSES, FAR 52.223-9, Certification and Estimate of Percentage of Recovered Material Content for EPA-Designated Items. Certification will be required upon contract completion unless a waiver has been approved by the Contracting Officer. The waiver must be approved prior to contract award.

10) Bidder's attention is directed to the CONTRACT CLAUSE, FAR 52.217-5, Evaluation of Options.

11) Determination of the Bidder's total price for the proposed work will be based on the TOTAL of the BASE SCHEDULE and OPTION SCHEDULE. Immediate award will be made of the BASE SCHEDULE. At the option of the Government, the OPTION SCHEDULE may be awarded at the bid price after Notice of Award for the BASE SCHEDULE. The Government does not guarantee any work beyond that of the BASE SCHEDULE. The Government reserves the right to pick up the OPTION SCHEDULE at the bid price within 120 calendar days after the Notice to Proceed.

CLAUSES INCORPORATED BY FULL TEXT

52.211-2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX OF SPECIFICATIONS AND STANDARDS (DODISS) AND DESCRIPTIONS LISTED IN THE ACQUISITION MANAGEMENT SYSTEMS AND DATA REQUIREMENTS CONTROL LIST, DOD 5010.12-L (DEC 1999)

Copies of specifications, standards, and data item descriptions cited in this solicitation may be obtained--

(a) From the ASSIST database via the Internet at http://assist.daps.mil; or

(b) By submitting a request to the--Department of Defense Single Stock Point (DoDSSP), Building 4, Section D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Telephone (215) 697-2667/2179, Facsimile (215) 697-1462.

(End of provision)

52.211-14 NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (SEP 1990)

Any contract awarded as a result of this solicitation will be DO-rated order certified for national defense use under the Defense Priorities and Allocations System (DPAS) (15 CFR 700), and the Contractor will be required to follow all of the requirements of this regulation.
(End of provision)

52.214-3 AMENDMENTS TO INVITATIONS FOR BIDS (DEC 1989)

(a) If this solicitation is amended, then all terms and conditions, which are not modified, remain unchanged.

(b) Bidders shall acknowledge receipt of any amendment to this solicitation (1) by signing and returning the amendment, (2) by identifying the amendment number and date in the space provided for this purpose on the form for submitting a bid, (3) by letter or telegram, or (4) by facsimile, if facsimile bids are authorized in the solicitation. The Government must receive the acknowledgment by the time and at the place specified for receipt of bids.

(End of provision)

52.214-4 FALSE STATEMENTS IN BIDS (APR 1984)

Bidders must provide full, accurate, and complete information as required by this solicitation and its attachments. The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

(End of provision)

52.214-5 SUBMISSION OF BIDS (MAR 1997)

(a) Bids and bid modifications shall be submitted in sealed envelopes or packages (unless submitted by electronic means) (1) addressed to the office specified in the solicitation, and (2) showing the time and date specified for receipt, the solicitation number, and the name and address of the bidder.

(b) Bidders using commercial carrier services shall ensure that the bid is addressed and marked on the outermost envelope or wrapper as prescribed in subparagraphs (a)(1) and (2) of this provision when delivered to the office specified in the solicitation.

(c) Telegraphic bids will not be considered unless authorized by the solicitation; however, bids may be modified or withdrawn by written or telegraphic notice.

(d) Facsimile bids, modifications, or withdrawals, will not be considered unless authorized by the solicitation.

(e) Bids submitted by electronic commerce shall be considered only if the electronic commerce method was specifically stipulated or permitted by the solicitation.

(End of provision)

52.214-6 EXPLANATION TO PROSPECTIVE BIDDERS (APR 1984)

Any prospective bidder desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing soon enough to allow a reply to reach all prospective bidders before the submission of their bids. Oral explanations or instructions given before the award of a contract will not be binding. Any information given a prospective bidder concerning a solicitation will be furnished promptly to all other prospective bidders as an amendment to the solicitation, if that information is necessary in submitting bids or if the lack of it would be prejudicial to other prospective bidders.

(End of provision)

52.214-7 LATE SUBMISSIONS, MODIFICATIONS, AND WITHDRAWALS OF BIDS (NOV 1999)

(a) Bidders are responsible for submitting bids, and any modifications or withdrawals, so as to reach the Government office designated in the invitation for bids (IFB) by the time specified in the IFB. If no time is specified in the IFB, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that bids are due.

(b)(1) Any bid, modification, or withdrawal received at the Government office designated in the IFB after the exact time specified for receipt of bids is “late” and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late bid would not unduly delay the acquisition; and--

(i) If it was transmitted through an electronic commerce method authorized by the IFB, it 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 bids; or

(ii) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of bids and was under the Government's control prior to the time set for receipt of bids.

(2) However, a late modification of an otherwise successful bid that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

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

(d) If an emergency or unanticipated event interrupts normal Government processes so that bids cannot be received at the Government office designated for receipt of bids by the exact time specified in the IFB and urgent Government requirements preclude amendment of the IFB, the time specified for receipt of bids 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.

(e) Bids may be withdrawn by written notice received at any time before the exact time set for receipt of bids. If the IFB authorizes facsimile bids, bids may be withdrawn via facsimile received at any time before the exact time set for receipt of bids, subject to the conditions specified in the provision at 52.214-31, Facsimile Bids. A bid may be

withdrawn in person by a bidder or its authorized representative if, before the exact time set for receipt of bids, the identity of the person requesting withdrawal is established and the person signs a receipt for the bid.

(End of provision)

52.214-18 PREPARATION OF BIDS--CONSTRUCTION (APR 1984)

(a) Bids 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 bid must initial each erasure or change appearing on any bid form.

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

(1) Lump sum bidding;

(2) Alternate prices;

(3) Units of construction; or

(4) Any combination of subparagraphs (1) through (3) above.

(c) If the solicitation requires bidding on all items, failure to do so will disqualify the bid. If bidding on all items is not required, bidders should insert the words "no bid" in the space provided for any item on which no price is submitted.

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

(End of provision)

52.214-19 CONTRACT AWARD--SEALED BIDDING--CONSTRUCTION (AUG 1996)

(a) The Government will evaluate bids in response to this solicitation without discussions and will award a contract to the responsible bidder whose bid, conforming to the solicitation, will be most advantageous to the Government, considering only price and the price-related factors specified elsewhere in the solicitation.

(b) The Government may reject any or all bids, and waive informalities or minor irregularities in bids received.

(c) The Government may accept any item or combination of items, unless doing so is precluded by a restrictive limitation in the solicitation or the bid.

(d) The Government may reject a bid as nonresponsive if the prices bid are materially unbalanced between line items or subline items. A bid is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated in relation to cost for other work, and if there is a reasonable doubt that the bid will result in the lowest overall cost to the Government even though it may be the low evaluated bid, or if it is so unbalanced as to be tantamount to allowing an advance payment.

(End of provision)

52.214-34 SUBMISSION OF OFFERS IN THE ENGLISH LANGUAGE (APR 1991)

Offers submitted in response to this solicitation shall be in the English language. Offers received in other than English shall be rejected.

(End of provision)

52.214-35 SUBMISSION OF OFFERS IN U.S. CURRENCY (APR 1991)

Offers submitted in response to this solicitation shall be in terms of U.S. dollars. Offers received in other than U.S. dollars shall be rejected.

(End of provision)

52.214-5000 ARITHMETIC DISCREPANCIES (MAR 1995)

(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 bidder:

(1) Obviously misplaced decimal points will be corrected;
(2) Discrepancy between unit price and extended price, the unit price will govern;
(3) Apparent errors in extension of unit prices will be corrected;
(4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purpose of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid 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.

(End of Statement)

52.215-16 FACILITIES CAPITAL COST OF MONEY (OCT 1997)

(a) Facilities capital cost of money will be an allowable cost under the contemplated contract, if the criteria for allowability in subparagraph 31.205-10(a)(2) of the Federal Acquisition Regulation are met. One of the allowability criteria requires the prospective contractor to propose facilities capital cost of money in its offer.

(b) If the prospective Contractor does not propose this cost, the resulting contract will include the clause Waiver of Facilities Capital Cost of Money.

(End of provision)

52.216-1 TYPE OF CONTRACT (APR 1984)

The Government contemplates award of a FIRM FIXED PRICED type contract resulting from this solicitation.

(End of clause)

252.204-7004 REQUIRED CENTRAL CONTRACTOR REGISTRATION.(NOV 2001)

(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 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 offeror 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 the 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://www.ccr.gov.

(End of clause)

FIELD OFFICE OVERHEAD PERCENTAGE MARKUP

If any change to the contract, issued pursuant to the changes Clause or otherwise, for which the Government is responsible, causes an increase or decrease in the Contractor’s cost of, of the time required for, performance under the contract, the Contracting Officer shall make an equitable adjustment and modify the contract in writing.

Under such equitable adjustment, no per diem rate for field office overhead shall be allowed if the Contractor has elected a percentage markup in keeping with its standard accounting practices. In such a case, payment of field office overhead shall be allowed for any change on a percentage markup basis regardless of whether the completion of the contract is or is not extended by reason of the change, except for modifications issued pursuant to the Default Clause. The Contractor shall provide a detailed breakdown of its proposed increase or decrease of costs as required by Contract Clause DFARS 252.236-7001 MODIFICATION OF PROPOSALS – PRICE BREAKDOWN.

FIELD OFFICE OVERHEAD PER DIEM RATE

If any change to the contract, issued pursuant to the Changes Clause or otherwise, for which the Government is responsible, causes an increase or decrease in the Contractor’s cost of, or the time required for, performance under the contract, the Contracting Officer shall make an equitable adjustment and modify the contract in writing.

Under such equitable adjustment, no payment of field office overhead shall be allowed for any changes when the completion of the contract is not extended by reason of the change, except the Contractor may be reimbursed any

variable expense it incurs due to the change, provided it can substantiate the variables. The Contractor shall be reimbursed for field office overhead on a per diem basis when the completion of the contract is extended by reason of the change issued under any clause except the Default clause. Equitable adjustment shall be made for the costs that are incurred or are to be incurred due to the change. The Contractor shall provide a detailed breakdown of its proposed increase or decrease of costs as required by Contract Clause DFARS 252.236-7001 MODIFICATION OF PROPOSALS – PRICE BREAKDOWN.

THE MAGNITUDE OF THIS PROJECT IS REPRESENTED BY THE FOLLOWING ESTIMATED PRICE RANGE (See FAR 36.204): Between $ 1,000,000.00 and $ 5,000,000.00.

PRE-BID MEETING (See FAR 14.207)

A pre-bid meeting will be held at the construction site. All questions and comments regarding this project should be submitted in written form at this meeting to the Project Manager, Mike Greene. Questions may be submitted ahead of the meeting by fax to Mr. Greene at 785-239-6678. Problems will be resolved by amendment to the advertised plans and specifications. The pre-bid meeting will be held 14 August 2002, 1:30, at building 446. Questions pertaining to the meeting should be directed by telephone inquiry to Mike Greene. Telephone Mr. Greene at 785-239-2044.

(End of provision)

SITE VISIT (CONSTRUCTION)(FEB 1995)(FAR 52.236-27). Prospective bidders will be given an escorted tour of the jobsite by appointment, between the hours of 8 a.m. and 2 p.m., Wednesday thru Friday. However, bidders will be required to make arrangements with Rex Willey, DCA Office, at least two (2) days prior to the visit, so an escort can be provided. Information pertaining to time and place of assembly for inspection tours will be provided by telephone inquiry or addressing correspondence to Mr. Rex Willey, rex.willey@riley.army.mil. Telephone Mr. Willey at 785-239-2508.

(End of provision)

SECTION 00600 Representations & Certifications

CLAUSES INCORPORATED BY FULL TEXT

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

(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 of 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 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 provison _____ (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 named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; 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)

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

(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 of 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, 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)

52.204-3 TAXPAYER IDENTIFICATION (OCT 1998)

(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 of 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)

52.204-5 WOMEN-OWNED BUSINESS (OTHER THAN SMALL BUSINESS) (MAY 1999)

(a) Definition. Women-owned business concern, as used in this provision, means a concern that 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 its stock is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(b) Representation. [Complete only if the offeror is a women-owned business concern and has not represented itself as a small business concern in paragraph (b)(1) of FAR 52.219-1, Small Business Program Representations, of this solicitation.] The offeror represents that it ( ) is a women-owned business concern.

(End of provision)

52.209-5 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND

OTHER RESPONSIBILITY MATTERS (DEC 2001)

(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)

52.214-14 PLACE OF PERFORMANCE--SEALED BIDDING (APR 1985)

(a) The bidder, in the performance of any contract resulting from this solicitation, [ ] intends, [ ] does not intend [check applicable box] to use one or more plants or facilities located at a different address from the address of the

bidder as indicated in this bid.

(b) If the bidder checks "intends" in paragraph (a) above, it shall insert in the spaces provided below the required information:

Place of Performance (Street, Address, City, County, State, Zip Code)	Name and Address of Owner and Operator of the Plant or Facility if Other than Bidder
_____	_____
_____	_____
_____	_____
_____	_____

(End of provision)

52.219-1 SMALL BUSINESS PROGRAM REPRESENTATIONS (APR 2002)

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is 23332.

(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 the 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 the 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 only if the 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 veteran-owned small business concern.

(5) (Complete only if the offeror represented itself as a veteran-owned small business concern in paragraph (b)(4) of this provision.) The offeror represents as part of its offer that it ( ) is, ( ) is not a service-disabled veteran-owned small business concern.

(6) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents, as part of its offer, that--

(i) It ( ) is, ( ) is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material change in ownership and control, principal office, or HUBZone employee percentage has occurred since it was certified by the Small Business Administration in accordance with 13 CFR part 126; and

(ii) It ( ) is, ( ) is not a joint venture that complies with the requirements of 13 CFR part 126, and the representation in paragraph (b)(6)(i) of this provision is accurate for the HUBZone small business concern or concerns that are participating in the joint venture. (The offeror shall enter the name or names of the HUBZone small business concern or concerns that are participating in the joint venture: _____.) Each HUBZone small business concern participating in the joint venture shall submit a separate signed copy of the HUBZone representation.

(c) Definitions. As used in this provision--

Service-disabled veteran-owned small business concern--

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

"Small business concern," 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.

Veteran-owned small business concern means a small business concern--

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

"Women-owned small business concern," means a small business concern --

(1) That 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, HUBZone small, small disadvantaged, or women-owned small business concern in order to obtain a contract to be awarded under the preference programs established pursuant to section 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)

52.219-19 SMALL BUSINESS CONCERN REPRESENTATION FOR THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (OCT 2000)

(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 North American Industry Classification System (NAICS) 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). (Check one of the following.)

No. of Employees 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)

52.219-21 SMALL BUSINESS SIZE REPRESENTATION FOR TARGETED INDUSTRY CATEGORIES UNDER THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (MAY 1999)

(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.)

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). (Check one of the following.)

No. of Employees 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

____ 17 million

(End of provision)

52.222-21 PROHIBITION OF SEGREGATED FACILITIES (FEB 1999)

(a) Segregated facilities, as used in this clause, 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, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.

(b) The Contractor agrees 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 Contractor agrees that a breach of this clause is a violation of the Equal Opportunity clause in this contract.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Opportunity clause of this contract.

(End of clause)

52.223-4 RECOVERED MATERIAL CERTIFICATION (OCT 1997)

As required by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6962(c)(3)(A)(i)), the offeror certifies, by signing this offer, that the percentage of recovered materials to be used in the performance of the contract will be at least the amount required by the applicable contract specifications.

(End of provision)

52.223-13 CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (OCT 2000)

(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 facility 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 Standard Industrial Classification Code (SIC) major groups 20 through 39 or their corresponding North American Industry Classification System (NAICS) sectors 31 through 33; 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.

52.246-12 INSPECTION OF CONSTRUCTION (AUG 1996)

(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 completed work under paragraph (i) of this section.

(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)

252.209-7001 DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A TERRORIST COUNTRY (MAR 1998)

(a) "Definitions."

As used in this provision --

(a) "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 such 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 indebtness 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 or, in the case of a subsidiary, the firm that

owns the 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 disclosure 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)

252.247-7022 REPRESENTATION OF EXTENT OF TRANSPORTATION BY SEA (AUG 1992)

(a) The Offeror shall indicate by checking the appropriate blank in paragraph (b) of this provision whether transportation of supplies by sea is anticipated under the resultant contract. The term supplies is defined in the Transportation of Supplies by Sea clause of this solicitation.

(b) Representation. The Offeror represents that it:

____ (1) Does anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

____ (2) Does not anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

(c) Any contract resulting from this solicitation will include the Transportation of Supplies by Sea clause. If the Offeror represents that it will not use ocean transportation, the resulting contract will also include the Defense FAR Supplement clause at 252.247-7024, Notification of Transportation of Supplies by Sea.

(End of provision)

SECTION 00700 Contract Clauses

CLAUSES INCORPORATED BY REFERENCE:

52.202-1	Definitions	DEC 2001
52.203-3	Gratuities	APR 1984
52.203-5	Covenant Against Contingent Fees	APR 1984
52.203-6 Alt I	Restrictions On Subcontractor Sales To The Government (Jul 1995) -- Alternate I	OCT 1995
52.203-7	Anti-Kickback Procedures	JUL 1995
52.203-8	Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity	JAN 1997
52.203-10	Price Or Fee Adjustment For Illegal Or Improper Activity	JAN 1997
52.203-12	Limitation On Payments To Influence Certain Federal Transactions	JUN 1997
52.204-4	Printed or Copied Double-Sided on Recycled Paper	AUG 2000
52.209-6	Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment	JUL 1995
52.211-15	Defense Priority And Allocation Requirements	SEP 1990
52.211-18	Variation in Estimated Quantity	APR 1984
52.214-26	Audit and Records--Sealed Bidding	OCT 1997
52.214-27	Price Reduction for Defective Cost or Pricing Data - Modifications - Sealed Bidding	OCT 1997
52.214-28	Subcontracting Cost Or Pricing Data--Modifications--Sealed Bidding	OCT 1997
52.215-21	Requirements for Cost or Pricing Data or Information Other Than Cost or Pricing Data--Modifications	OCT 1997
52.219-4	Notice of Price Evaluation Preference for HUBZone Small Business Concerns	JAN 1999
52.219-8	Utilization of Small Business Concerns	OCT 2000
52.219-16	Liquidated Damages-Subcontracting Plan	JAN 1999
52.222-1	Notice To The Government Of Labor Disputes	FEB 1997
52.222-3	Convict Labor	AUG 1996
52.222-4	Contract Work Hours and Safety Standards Act - Overtime Compensation	SEP 2000
52.222-6	Davis Bacon Act	FEB 1995
52.222-7	Withholding of Funds	FEB 1988
52.222-8	Payrolls and Basic Records	FEB 1988
52.222-9	Apprentices and Trainees	FEB 1988
52.222-10	Compliance with Copeland Act Requirements	FEB 1988
52.222-11	Subcontracts (Labor Standards)	FEB 1988
52.222-12	Contract Termination-Debarment	FEB 1988
52.222-13	Compliance with Davis-Bacon and Related Act Regulations.	FEB 1988
52.222-14	Disputes Concerning Labor Standards	FEB 1988
52.222-15	Certification of Eligibility	FEB 1988
52.222-26	Equal Opportunity	APR 2002
52.222-27	Affirmative Action Compliance Requirements for Construction	FEB 1999
52.222-35	Equal Opportunity For Special Disabled Veterans, Veterans of the Vietnam Era and Other Eligible Veterans	DEC 2001
52.222-36	Affirmative Action For Workers With Disabilities	JUN 1998
52.222-37	Employment Reports On Special Disabled Veterans, Veterans Of The Vietnam Era and Other Eligible Veterans	DEC 2001
52.223-3	Hazardous Material Identification And Material Safety Data	JAN 1997

52.223-6	Drug Free Workplace	MAY 2001
52.223-9	Estimate of Percentage of Recovered Material Content for EPA-Designated Products	AUG 2000
52.223-14	Toxic Chemical Release Reporting	OCT 2000
52.223-14	Toxic Chemical Release Reporting	OCT 2000
52.225-9	Buy American Act--Construction Materials	MAY 2002
52.225-11	Buy American Act--Construction Materials Under Trade Agreements	MAY 2002
52.225-12	Notice of Buy American Act Requirement--Construction Materials Under Trade Agreements	MAY 2002
52.226-1	Utilization Of Indian Organizations And Indian-Owned Economic Enterprises	JUN 2000
52.226-1	Utilization Of Indian Organizations And Indian-Owned Economic Enterprises	JUN 2000
52.227-1	Authorization and Consent	JUL 1995
52.227-1	Authorization and Consent	JUL 1995
52.227-4	Patent Indemnity-Construction Contracts	APR 1984
52.228-2	Additional Bond Security	OCT 1997
52.228-2	Additional Bond Security	OCT 1997
52.228-5	Insurance - Work On A Government Installation	JAN 1997
52.228-5	Insurance - Work On A Government Installation	JAN 1997
52.228-11	Pledges Of Assets	FEB 1992
52.228-14	Irrevocable Letter of Credit	DEC 1999
52.228-15	Performance and Payment Bonds--Construction	JUL 2000
52.229-3	Federal, State And Local Taxes	JAN 1991
52.229-5	Taxes--Contracts Performed In U S Possessions Or Puerto Rico	APR 1984
52.232-5	Payments under Fixed-Price Construction Contracts	MAY 1997
52.232-17	Interest	JUN 1996
52.232-23	Assignment Of Claims	JAN 1986
52.232-27	Prompt Payment for Construction Contracts	FEB 2002
52.232-33	Payment by Electronic Funds Transfer--Central Contractor Registration	MAY 1999
52.233-1	Disputes	DEC 1998
52.233-3	Protest After Award	AUG 1996
52.236-2	Differing Site Conditions	APR 1984
52.236-3	Site Investigation and Conditions Affecting the Work	APR 1984
52.236-5	Material and Workmanship	APR 1984
52.236-6	Superintendence by the Contractor	APR 1984
52.236-7	Permits and Responsibilities	NOV 1991
52.236-8	Other Contracts	APR 1984
52.236-9	Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements	APR 1984
52.236-10	Operations and Storage Areas	APR 1984
52.236-11	Use and Possession Prior to Completion	APR 1984
52.236-12	Cleaning Up	APR 1984
52.236-13	Accident Prevention	NOV 1991
52.236-15	Schedules for Construction Contracts	APR 1984
52.236-17	Layout of Work	APR 1984
52.236-21	Specifications and Drawings for Construction	FEB 1997
52.236-26	Preconstruction Conference	FEB 1995
52.242-13	Bankruptcy	JUL 1995
52.242-14	Suspension of Work	APR 1984
52.243-4	Changes	AUG 1987
52.245-1	Property Records	APR 1984
52.245-2	Government Property (Fixed Price Contracts)	DEC 1989

52.248-3	Value Engineering-Construction	FEB 2000
52.249-2	Termination For Convenience Of The Government (Fixed-Price)	SEP 1996
52.249-10	Default (Fixed-Price Construction)	APR 1984
52.253-1	Computer Generated Forms	JAN 1991
52.253-1	Computer Generated Forms	JAN 1991
252.201-7000	Contracting Officer's Representative	DEC 1991
252.203-7001	Prohibition On Persons Convicted of Fraud or Other Defense-Contract-Related Felonies	MAR 1999
252.203-7002	Display Of DOD Hotline Poster	DEC 1991
252.204-7003	Control Of Government Personnel Work Product	APR 1992
252.204-7004	Required Central Contractor Registration	NOV 2001
252.205-7000	Provisions Of Information To Cooperative Agreement Holders	DEC 1991
252.209-7000	Acquisition From Subcontractors Subject To On-Site Inspection Under The Intermediate Range Nuclear Forces (INF) Treaty	NOV 1995
252.209-7004	Subcontracting With Firms That Are Owned or Controlled By The Government of a Terrorist Country	MAR 1998
252.219-7003	Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan (DOD Contracts)	APR 1996
252.223-7004	Drug Free Work Force	SEP 1988
252.225-7012	Preference For Certain Domestic Commodities	APR 2002
252.225-7031	Secondary Arab Boycott Of Israel	JUN 1992
252.227-7033	Rights in Shop Drawings	APR 1966
252.231-7000	Supplemental Cost Principles	DEC 1991
252.236-7000	Modification Proposals-Price Breakdown	DEC 1991
252.236-7008	Contract Prices-Bidding Schedules	DEC 1991
252.243-7001	Pricing Of Contract Modifications	DEC 1991
252.243-7002	Requests for Equitable Adjustment	MAR 1998
252.247-7023	Transportation of Supplies by Sea	MAR 2000
252.247-7024	Notification Of Transportation Of Supplies By Sea	MAR 2000

Use for all NAFI projects

1.68 NONAPPROPRIATED FUND INSTRUMENTALITY (NAFI):
1.69 PROGRESS PAYMENTS:
1.70 PAYMENT TO CONTRACTOR:

SECTION 00800 Special Contract Requirements

CLAUSES INCORPORATED BY FULL TEXT

52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall be required to (a) commence work under this contract within **10** calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 31 March 2004. The building will be turned over to the contractor for construction 1 February 2003. * The time stated for completion shall include final cleanup of the premises.

(End of clause)

52.211-12 LIQUIDATED DAMAGES--CONSTRUCTION (SEP 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of **$1,535.00** ($1,385.00 / DCA & $150.00 / PW & DOC) for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

(End of clause)

52.219-18 NOTIFICATION OF COMPETITION LIMITED TO ELIGIBLE 8(A) CONCERNS (JUN 1999)

(a) Offers are solicited only from small business concerns expressly certified by the Small Business Administration (SBA) for participation in the SBA's 8(a) Program and which meet the following criteria at the time of submission of offer--

(1) The Offeror is in conformance with the 8(a) support limitation set forth in its approved business plan; and

(2) The Offeror is in conformance with the Business Activity Targets set forth in its approved business plan or any remedial action directed by the SBA.

(b) By submission of its offer, the Offeror represents that it meets all of the criteria set forth in paragraph (a) of this clause.

(c) Any award resulting from this solicitation will be made to the Small Business Administration, which will subcontract performance to the successful 8(a) offeror selected through the evaluation criteria set forth in this solicitation.

(d)(1) Agreement. A small business concern submitting an offer in its own name agrees to furnish, in performing the contract, only end items manufactured or produced by small business concerns in the United States. The term “United States” includes its territories and possessions, the Commonwealth of Puerto Rico, the Trust Territory of the Pacific Islands, and the District of Columbia. If this procurement is processed under simplified acquisition procedures and the total amount of this contract does not exceed $25,000, a small business concern may furnish the product of any domestic firm. This paragraph does not apply in connection with construction or service contracts.

(2) The _____ [insert name of SBA's contractor] will notify the [insert name of contracting agency] Contracting Officer in writing immediately upon entering an agreement (either oral or written) to

transfer all or part of its stock or other ownership interest to any other party.

(End of clause)

52.231-5000 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE
MAR 1995)--EFARS

(a) This clause does not apply to terminations. See 52.249-5000, Basis for Settlement of Proposals and FAR Part 49.
(b) 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 _VII_. 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 the work was performed shall apply.
(c) 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.
(d) 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 Proposal Cover Sheet.

(End of clause)

52.232-5000 PAYMENT FOR MATERIALS DELIVERED OFF-SITE (MAR 1995)--EFARS

(a) Pursuant to FAR clause 52.232-5, Payments Under Fixed Priced 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 General Provisions are fulfilled. Payment for items delivered to locations other than the work site will be limited to: (1) materials required by the technical provisions; or (3) materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.
(b) 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 contractor 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:
_____

(End of clause)

52.236-1 PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984)

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.

52.236-4 PHYSICAL DATA (APR 1984)

Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

(a) The indications of physical conditions on the drawings and in the specifications are the result of site investigations.
(b) Weather conditions: Each bidder should satisfy himself before submitting his bid as to hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from the local National Weather Service Office.

(End of clause)

52.236-15 SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984)

(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 payments 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 deliver 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)

52.246-21 WARRANTY OF CONSTRUCTION (MAR 1994)

(a) In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (i) 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.

(b) 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.

(c) 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--

(1) The Contractor's failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished.

(d) 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.

(e) The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

(f) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.
(g) 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--

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(3) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

(h) In the event the Contractor's warranty under paragraph (b) of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

(i) 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.

(j) 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.

(End of clause)

252.219-7009 SECTION 8(A) DIRECT AWARD (MAR 2002)

(a) This contract is issued as a direct award between the contracting office and the 8(a) Contractor pursuant to the Partnership Agreement dated February 1, 2002, between the Small Business Administration (SBA) and the Department of Defense. Accordingly, the SBA, even if not identified in Section A of this contract, is the prime contractor and retains responsibility for 8(a) certification, for 8(a) eligibility determinations and related issues, and for providing counseling and assistance to the 8(a) Contractor under the 8(a) Program. The cognizant SBA district office is:

(To be completed by the Contracting Officer at the time of award)

(b) The contracting office is responsible for administering the contract and for taking any action on behalf of the Government under the terms and conditions of the contract; provided that the contracting office shall give advance

notice to the SBA before it issues a final notice terminating performance, either in whole or in part, under the contract. The contracting office also shall coordinate with the SBA prior to processing any novation agreement. The contracting office may assign contract administration functions to a contract administration office.

(c) The Contractor agrees that--

(1) It will notify the Contracting Officer, simultaneous with its notification to the SBA (as required by SBA's 8(a) regulations at 13 CFR 124.308), when the owner or owners upon whom 8(a) eligibility is based plan to relinquish ownership or control of the concern. Consistent with Section 407 of Pub. L. 100-656, transfer of ownership or control shall result in termination of the contract for convenience, unless the SBA waives the requirement for termination prior to the actual relinquishing of ownership and control; and

(2) It will not subcontract the performance of any of the requirements of this contract without the prior written approval of the SBA and the Contracting Officer.

(End of Clause)

252.219-7010 ALTERNATE A (JUN 1998)

(a) Offers are solicited only from small business concerns expressly certified by the Small Business Administration (SBA) for participation in the SBA's 8(a) Program and which meet the following criteria at the time of submission of offer--

(1) The Offeror is in conformance with the 8(a) support limitation set forth in its approved business plan; and

(2) The Offeror is in conformance with the Business Activity Targets set forth in its approved business plan or any remedial action directed by the SBA.

(b) By submission of its offer, the Offeror represents that it meets all of the criteria set forth in paragraph (a) of this clause.

(c) Any award resulting from this solicitation will be made directly by the Contracting Officer to the successful 8(a) offeror selected through the evaluation criteria set forth in this solicitation.

(d)(1) Agreement. A small business concern submitting an offer in its own name agrees to furnish, in performing the contract, only end items manufactured or produced by small business concerns in the United States. The term "United States" includes its territories and possessions, the Commonwealth of Puerto Rico, the trust territory of the Pacific Islands, and the District of Columbia. If this procurement is processed under simplified acquisition procedures and the total amount of this contract does not exceed $25,000, a small business concern may furnish the product of any domestic firm. This subparagraph does not apply in connection with construction or service contracts.

(2) The [insert name of SBA's contractor] will notify the [insert name of contracting agency] . Contracting Officer in writing immediately upon entering an agreement (either oral or written) to transfer all or part of its stock or other ownership interest to any other party.

(End of clause)

252.225-7014 PREFERENCE FOR DOMESTIC SPECIALTY METALS (MAR 1998)

(a) Definitions.

As used in this clause--

(1) Qualifying country means any country set forth in subsection 225.872-1 of the Defense Federal Acquisition Regulation Supplement.

(2) Specialty metals means--

(i) Steel--

(A) Where the maximum alloy content exceeds one or more of the following limits: manganese, 1.65 percent; silicon, 0.60 percent; or copper, 0.60 percent; or

(B) That contains more than 0.25 percent of any of the following elements: aluminum, chromium, cobalt, columbium, molybdenum, nickel, titanium, tungsten, or vanadium;

(ii) Metal alloys consisting of nickel, iron-nickel, and cobalt base alloys containing a total of other alloying metals (except iron) in excess of 10 percent;

(iii) Titanium and titanium alloys; or

(b) The Contractor agrees that any specialty metals incorporated in articles delivered under this contract will be melted in the United States, its possessions, or Puerto Rico.

(c) This clause does not apply to the extent that--

(1) The Secretary or designee determines that a satisfactory quality and sufficient quantity of such articles cannot be acquired when needed at U.S. market prices;

(2) The specialty metal is melted in a qualifying country or is incorporated in an article manufactured in a qualifying country;

(3) The acquisition is necessary to comply with agreements with foreign governments requiring the United States to purchase supplies from foreign sources to offset sales made by the U.S. Government or U.S. firms under approved programs; or

(4) The specialty metal is purchased by a subcontractor at any tier.

(End of clause)

252.225-7030 RESTRICTION ON ACQUISITION OF CARBON, ALLOY, AND ARMOR STEEL PLATE (OCT 1992)

The Contractor agrees that all carbon, alloy, and armor steel plate in Federal supply class 9515, or described by American Society for Testing Materials (ASTM) or American Iron and Steel Institute (AISI) specifications, furnished as a deliverable under this contract, or purchased by the contractor as a raw material, for use in a Government-owned facility or facility under the control of the Department of Defense, shall be melted and rolled in the United States or Canada.

(End of clause)

252.236-7001 CONTRACT DRAWINGS, MAPS, AND SPECIFICATIONS (AUG 2000)

(a) The Government will provide to the Contractor, without charge, one set of contract drawings and specifications, except publications incorporated into the technical provisions by reference, in electronic or paper media as chosen by the Contracting Officer.

(b) 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;

(4) Be responsible for any errors that might have been avoided by complying with this paragraph (b); and

(5) Reproduce and print contract drawings and specifications as needed.

(c) In general--

(1) Large-scale drawings shall govern small-scale drawings; and

(2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work that are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings identified on the following index of drawings:

SEE PLANS & SPECIFICATIONS

(End of clause)

(Use for all NAFI projects.)

1.67 (NAFI) DEFINITIONS:

(a) "Nonappropriated Fund Contracting Officer" means the person authorized in writing by an individual appointment or positions designation to execute or administer contracts on behalf of the nonappropriated fund instrumentality (NAFI) which is a party hereto, or his successor or successors.

(b) "Custodian" of the NAFI is an individual appointed by written authority to a post of responsibility and trust to exercise administrative and executive control of a nonappropriated fund and charged with accountability thereof.

(c) The word "Government" used herein applies to the nonappropriated fund instrumentality of the Department of the Army and as such is entitled to the same rights, privileges and immunities as the US Government.

(d) "Government-Furnished Equipment" pertains to equipment to be provided or furnished on site by means other than the Contractor.

(Use for all NAFI projects.)

1.68 NONAPPROPRIATED FUND INSTRUMENTALITY (NAFI): The Fund herein is a nonappropriated fund instrumentality of the Department of the Army. No appropriated funds of the United States shall become due, or be paid, the Contractor by reason of this contract.

(Use for all NAFI projects.)

1.69 PROGRESS PAYMENTS: Progress payments are authorized for contracts which exceed $50,000. In making such progress payments, there shall be retained 10 percent of the estimated amount of payment until final

completion and acceptance of the contract work. However, if the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, he may authorize such payment to be made in full without retention of a percentage. Also, whenever the work is substantially complete, the Contracting Officer shall retain an amount he considers adequate for protection of the fund, and, at his discretion, may release to the Contractor all or a portion of any excess amount. Furthermore, on completion and acceptance of each separate building, public work, or other division of the contract, on which the price is stated separately in the contract, payment may be made therefore without retention of a percentage.

(Use for all NAFI projects.)

1.70 PAYMENT TO CONTRACTOR:

(a) The fund will pay the contract price as hereinafter provided.

(b) Upon completion and acceptance of all work, the amount due the Contractor under this contract shall be paid upon the presentation of a properly executed voucher and after the Contractor shall have furnished the Fund with a release, if required, of all claims against the Fund arising by virtue of this contract, other than claims in stated amounts as may be specifically excepted by the Contractor from the operation of the release.

(Use for all NAFI projects.)

1.67 (NAFI) DEFINITIONS:

(a) "Nonappropriated Fund Contracting Officer" means the person authorized in writing by an individual appointment or positions designation to execute or administer contracts on behalf of the nonappropriated fund instrumentality (NAFI) which is a party hereto, or his successor or successors.

(b) "Custodian" of the NAFI is an individual appointed by written authority to a post of responsibility and trust to exercise administrative and executive control of a nonappropriated fund and charged with accountability thereof.

(c) The word "Government" used herein applies to the nonappropriated fund instrumentality of the Department of the Army and as such is entitled to the same rights, privileges and immunities as the US Government.

(d) "Government-Furnished Equipment" pertains to equipment to be provided or furnished on site by means other than the Contractor.

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SECTION 00810

WAGE RATES

1. General Decision KS020010, dated 06/07/2002, 3 mods.
2. General Decision KS020011, dated 06/07/2002, 3 mods.
3. General Decision KS020027, dated 03/01/2002, no mods.

GENERAL DECISION KS020010 06/07/02 KS10
General Decision Number KS020010

Superseded General Decision No. KS010010

State: Kansas

Construction Type:
BUILDING

County(ies):
GEARY

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	03/01/2002
1	04/05/2002
2	05/10/2002
3	06/07/2002

COUNTY(ies):
GEARY

* PLUM0165E 06/01/2002

	Rates	Fringes
PLUMBERS	25.24	7.85

* ROOF0020P 06/01/2002

	Rates	Fringes
ROOFERS	21.76	6.44

SFKS0669B 04/01/2002

	Rates	Fringes
SPRINKLERFITTERS	27.01	7.05

SHEE0077C 06/01/2001

	Rates	Fringes
SHEETMETAL WORKERS (Including HVAC Duct Work)	23.58	7.34

SUKS1024A 03/01/2000

	Rates	Fringes
BRICKLAYERS	18.00	
CARPENTER (Including Drywall Hanging and Excluding Installation, Batt)	12.93	3.01
CEMENT MASON	11.00	0.44

LABORERS:

Unskilled (Excluding Blown Insulation)	8.42	
PAINTER, BRUSH/ROLLER		
(Including Drywall Finishing)	11.39	
POWER EQUIPMENT OPERATOR:		
Backhoe	13.19	2.68
Rollers (All Types)	10.53	

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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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 KS020011 06/07/02 KS11
General Decision Number KS020011

Superseded General Decision No. KS010011

State: Kansas

Construction Type:
BUILDING

County(ies):
RILEY

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	03/01/2002
1	04/05/2002
2	05/10/2002
3	06/07/2002

COUNTY(ies):
RILEY

* PLUM0165A 06/01/2002

	Rates	Fringes
PLUMBERS	25.24	7.85

* ROOF0020P 06/01/2002

	Rates	Fringes
ROOFERS	21.76	6.44

SFKS0669B 04/01/2002

	Rates	Fringes
SPRINKLERFITTERS	27.01	7.05

SHEE0077C 06/01/2001

	Rates	Fringes
SHEETMETAL WORKERS (Including HVAC Duct Work)	23.58	7.34

SUKS1029A 03/01/2000

	Rates	Fringes
BRICKLAYERS	18.00	
CARPENTERS (Including Drywall Hanging and Excluding Insulation, Batt)	12.93	3.01
CEMENT MASONS	11.00	0.44

LABORERS:

Unskilled (Excluding Blown Installation)	8.42	
PAINTER:		
Brush/Roller (Including Drywall Finishing)	11.39	
POWER EQUIPMENT OPERATORS:		
Backhoe	13.19	2.68
Rollers (All Types)	10.53	

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
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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:

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The request should be accompanied by a full statement of the interested party's position and by any information (wage payment

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200 Constitution Avenue, N. W.
Washington, D. C. 20210

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END OF GENERAL DECISION

GENERAL DECISION KS020027 03/01/02 KS27
 General Decision Number KS020027

 Superseded General Decision No. KS010027

 State: Kansas

 Construction Type:
 HEAVY
 SEWER AND WATER LINE

 County(ies):
 GEARY RILEY

 HEAVY, SEWER AND WATER LINE CONSTRUCTION PROJECTS

 Modification Number Publication Date
 0 03/01/2002

COUNTY(ies):
GEARY RILEY

 SUKS2002A 01/22/1988

	Rates	Fringes
BRICKLAYERS	15.89	
CARPENTERS	10.06	1.80
CEMENT MASONS	8.93	
ELECTRICIANS	14.24	1.25
FORM SETTERS	7.10	
LABORERS:		
Laborers	6.23	1.52
Pipelayers	5.83	
Rebar workers	11.18	
PIPEFITTERS	16.74	
PLUMBERS	17.65	1.98
POWER EQUIPMENT OPERATORS:		
Backhoe	7.59	
Bulldozer	6.50	
Crane	8.55	
Grader	7.47	
Loader	7.70	
TRUCK DRIVERS	5.94	

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:

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END OF GENERAL DECISION

DIVISION 1 – GENERAL REQUIREMENTS

01010	Summary of Work
01100	General
01300	Submittal Procedures
01355	Environmental Protection
01440	Construction Quality Management—Contractor Quality Control
01500A	Temporary Construction Facilities
01720	As-Builts

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 SCOPE: This project consists of furnishing all plant, labor, equipment, materials, and transportation and performing all required work in accordance with the plans and specifications for the renovation of Riley's, Building 446.

1.1.1 Location: Site of the required work is Riley's, Building 446, Main Post, Fort Riley, Kansas.

1.1.2 Principal Features: Required work includes the principal features listed below. Outline of principal features does not limit the responsibility of the Contractor to furnish all plant, labor, equipment, materials, and transportation and perform all work required by the plans and specifications.

1.1.2.1 Demolish existing interior masonry and gypboard partitions as indicated.

1.1.2.2 Demolish existing heating, ventilating and air conditioning sytem.

1.1.2.3 Demolish existing electrical system.

1.1.2.4 Demolish existing concrete loading dock, concrete ramp and sidewalks on the exterior.

1.1.2.5 Cut openings in the existing concrete roof deck for new skylights.

1.1.2.6 Cut openings in the existing concrete wall panels for new doors and windows.

1.1.2.7 Demolish existing interior concrete stairs and existing exterior metal stairs.

1.1.2.8 Remove existing asbestos containing floor tile.

1.1.2.9 Demolish all interior finishes, including suspended ceilings and floor coverings.

1.1.2.10 Remove all existing toilet partitions and plumbing fixtures.

1.1.2.11 Remove existing food service equipment, including range hoods, dishwasher, fryers, grills, ovens, counters, ice makers, walk-in refrigerators, walk-in freezer and storage racks.

1.1.2.12 Remove existing storefront entry doors.

1.1.2.13 Cut openings in concrete terrace deck for new elevator and stair addition.

1.1.2.14 Install new interior masonry and gypboard partitions.

1.1.2.15 Install new interior finishes.

1.1.2.16 Install new aluminum storefront entrances on the existing building and the new addition.

1.1.2.17 Install new aluminum windows.

1.1.2.18 Install new pyramid skylights.

1.1.2.19 Construct new concrete and masonry addition with an elevator and stairway.

1.1.2.20 Install new operable wall partitions.

1.1.2.21 Install owner supplied food service equipment.

1.1.2.22 Install new heating, ventilating, and air conditioning system.

1.1.2.23 Install new electrical system.

1.1.2.24 Install new sprinkler system.

1.1.2.25 Spray-on insulation to under side of the existing roof deck and furr-out and insulate exterior walls.

1.1.2.26 Apply waterproofing finish to exterior surface of concrete wall panels.

1.1.2.27 Repair existing modified bitumen roof including replacing cap flashing and base flashing at highest roof section.

1.1.2.28 Construct new loading dock with hydraulic lift.

1.1.2.29 Construct new concrete sidewalk and ramp at west entrance.

1.1.2.30 Reconfigure plumbing system for relocated and added fixtures.

1.1.2.31 Install new audio-visual equipment.

1.1.2.32 Install new window treatments.

1.1.2.33 Remodel canopy at main entrance.

1.1.2.34 Maintain work area(s) in neat, orderly and safe condition during the course of the work, and clean up work area(s) at the end of each workday and upon completion of the work. Dispose of debris and salvageable items as specified in SECTION 02050, DEMOLITION.

1.1.2.35 Prepare, maintain, and submit as-built drawings as required.

1.2 APPLICABLE PUBLICATIONS: The US Army Corps of Engineers Manual (EM) listed below forms a part of this section to the extent referenced. Publication is referred to in the text by basic designation only. Publication shall be assumed to be the most current edition in effect at the time a contract is awarded.

385-1-1 General Safety and Health Requirements.

1.3 SUBMITTALS:

1.3.1 Accident Prevention Plan: Submit an Accident Prevention Plan.

1.3.2 Quality Control Plan: Submit a Quality Control (QC) Plan.

1.3.3 Other Submittals: See specific specification sections.

1.4 GENERAL REQUIREMENTS:

1.4.1 Verification of Conditions and Dimensions: Review plans and specifications and visit the work site(s) to become thoroughly familiar with details of the required work and site conditions, verify all dimensions prior to ordering materials and fabricating components, and notify the Contracting Officer of any discrepancies between the plans and specifications and actual conditions. All discrepancies shall be resolved before the Contractor begins work. It is strongly suggested the Contractor verify conditions and dimensions prior to preparing and submitting his bid.

1.4.2 Delivery and Storage: Deliver materials to the work site in undamaged, unopened manufacturer's standard packaging or containers. Store materials to protect them from physical damage, theft, vandalism, and weather.

1.4.3 Marking and Labeling: Manufacturer's standard packaging and containers, or when appropriate, individual pieces of material shall be marked or labeled showing the name of the manufacturer; brand name; model number, stock number, or other designations; item description; and when applicable, the stamp of a nationally recognized, independent testing laboratory or agency, certifying materials conform to the requirements specified.

1.4.4 Proprietary Products: Unless otherwise specified, proprietary products indicated in the specifications or noted on the plans are intended to establish capacities, color, design, features, pattern, quality, and style of materials desired, and are not intended to limit trade. Materials proposed for use which can be determined by the Contracting Officer to conform to the requirements specified, may be substituted and installed after his approval.

1.4.5 Coordination: Coordinate work performed by specific trades with work performed by other trades to the extent required.

1.4.6 Identification Cards: All Contractor and Subcontractor personnel shall wear identification cards while working at Fort Riley. Identification cards shall show a photograph of the employee; name of employee; and name, address, and phone number of the Contractor or Subcontractor.

1.4.7 Vehicle Identification: All Contractor and Subcontractor vehicles and equipment shall bear the Contractor or Subcontractor's name or logo while the vehicles and equipment are working at Fort Riley. Names or Logos shall be applied to both sides of vehicles and equipment as a minimum.

1.5 SAFETY AND PROTECTION:

1.5.1 Safety Requirements: Take safety precautions to protect workmen, building occupants, and the public from construction equipment and materials being removed and installed at the work site. Maintain free and safe passage into and out of adjoining or adjacent building and areas not part of this project. Comply with EM 385-1-1 while performing the required work in this project.

1.5.2 Accident Prevention Plan: Prepare and submit an Accident Prevention Plan in accordance with paragraph 01.A.07, EM 385-1-1. Implement the approved plan not later than the contract start date.

1.5.3 Protection of Property: Protect all property, both Government and personal, indoors and outdoors, including buildings, site improvements, utilities, vegetation, and vehicles at or adjacent to the work site, and which might be damaged during the course of the required work. Do not operate heavy construction equipment on drives, sidewalks, or lawns without installing suitable protection on these surfaces. When the building(s) is unoccupied, and the Contractor is issued keys to the building(s), insure the building(s) is kept locked when he is not on the premises and the keys are kept secure.

1.5.4 Barricades, Warning Signs, and Lights: Install all necessary barricades, warning signs, and lights to protect workmen, building occupants, the public, and adjacent property.

1.7 WORKING HOURS: Once begun, work shall continue uninterrupted during normal working hours until it is complete. Schedule working hours to coincide with working hours of the military installation. Normal work hours are from 7:30 a.m. to 4:30 p.m., Monday thru Friday, Federal holidays excepted. Do not perform work on the installation on other days or other hours without the written approval of the Contracting Officer. The Federal holidays listed below are observed. When a holiday falls on a Sunday, the following Monday will be observed as the holiday. When the holiday falls on a Saturday, the preceding Friday will be observed as the holiday. Contractors are also requested to not schedule work on Christmas Eve and New Year's Eve.

New Year's Day	Labor Day
Martin Luther King's Birthday	Columbus Day
Presidents' Day	Veterans' Day
Memorial Day	Thanksgiving Day
Independence Day	Christmas Day

1.8 QUALITY CONTROL: Develop, submit, implement, and maintain a quality control system which meets or exceeds the requirements of SECTION 01440, CONSTRUCTION QUALITY MANAGEMENT - CONTRACTOR QUALITY CONTROL. Implement the approved plan not later than the contract start date.

1.9 AS-BUILT DRAWINGS: Prepare and submit as-built drawings in accordance with SECTION 01720, AS-BUILT DRAWINGS.

1.10 WARRANTY OF CONSTRUCTION: Warrant construction in accordance with Contract Clause FAR 52.246-0021 entitled: Warranty of Construction.

1.11 DISCONNECTION AND RECONNECTION OF ELECTRICAL AND GAS SERVICES: When the required work presents a fire hazard, comply with the requirements listed below. Disconnection, reconnection, and operational checks shall be performed by workmen qualified to accomplish the tasks.

1.11.1 Electrical Service: Electrical service to the building shall be shut off at the main distribution panel prior to commencing work. After the fire hazard has been eliminated, the electrical services shall be turned back on.

1.11.2 Gas Service: Gas service to the building shall be shut off by first shutting off all pilot lights, and then by shutting off the outside gas shut-off valve. After the fire hazard has been eliminated, the gas service shall be restored and all pilot lights relit. Check each gas-fired appliance for proper operation after relighting the pilot light.

1.12 INTERRUPTION OF SERVICES: If the project requires interruption of utility and fire protection services to buildings or facilities, coordinate the interruption with building occupants and obtain written approval from the Contracting Officer. Unless otherwise specified, provide temporary water, sewer, electrical, gas, and fire protection services to the buildings or facilities when the required work cannot be accomplished in one workday. Relight pilot lights and check gas-fired equipment for proper operation after relighting pilot lights.

1.13 ADDITIONAL INFORMATION: Publications referenced in the specifications and as-built drawings for most buildings are available for review at the Engineering Plans and Services Division, Public Works, Building 408, Fort Riley.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

SECTION 01100

GENERAL

PART 1 GENERAL

1.1 INQUIRIES

Pursuant to SECTION 00100 paragraph titled "Explanation to Prospective Bidders", any inquiries regarding this Invitation, before bids are opened, should be addressed to the District Engineer, Kansas City District, Corps of Engineers, CENWK-PM-MO, 700 Federal Building, Kansas City, Missouri 64106, ATTN: Mr. Michael Greene. Inquiries for which oral explanation or advice on the plans and specifications will suffice may be referred to Mr. Greene by calling Area Code 785-239-2044. Telephone calls concerning the mailing of plans and specifications should be made to Contracting Division at Area Code 816-983-3975. Collect telephone calls will not be accepted. (KCDO APR 84)

1.2 SUPERINTENDENCE OF SUBCONTRACTORS

(a) The Contractor shall be required to furnish the following:

(1) If more than 50% and less than 70% of the value of the contract work is subcontracted, one superintendent shall be provided at the site and on the Contractor's payroll to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

(2) If 70% or more of the value of the work is subcontracted, the Contractor shall be required to furnish two such superintendents to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

(b) If the Contracting Officer, at any time after 50% of the subcontracted work has been completed, finds that satisfactory progress is being made, he may waive all or part of the above requirement 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.

1.3 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 may be approved and directed by the Contracting Office. All prescribed identification shall immediately be delivered to the Contracting Officer, for cancellation upon the release of any 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.

1.4 APPLICATION OF WAGE RATES

The inclusion of the Davis-Bacon Act General Wage Decision or the Service Contract Act Wage Determination in the solicitation is a statutory requirement. It is not a representation by the U.S. Army Corps of Engineers that any specific work task can be performed by any specific trade. Which work tasks can be performed by what trades depends on and is determined by the prevailing area practice for the local area where the

contract is being performed. It is the sole responsibility of the bidder to determine and comply with the prevailing area practice. Inquiries regarding a prevailing area practice should be directed to the Corps of Engineers, Contractor Industrial Relations Specialist (telephone number 816-983-3723) or to the Department of Labor Regional Wage and Hour Division.

Application of wage rates and fringe benefits: For the application of the wage rates and fringe benefits contained in the Decisions of the Secretary of Labor, attached to and a part of this contract, all work required within 5 feet outside building lines shall be considered Building Construction. All other construction not defined herein as Building Construction shall be considered Heavy Construction.

1.5 PAYMENTS TO SUBCONTRACTORS

The Contractor's attention is directed to CONTRACT CLAUSE titled "Payment Under Fixed-Price Construction Contracts." In addition to the requirements set forth in the referenced paragraph, the Government will reimburse the Contractor, upon request, for amount of premiums paid by the subcontractors for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor furnishes evidence of full payment to the surety.

1.6 PAYMENTS TO CONTRACTOR (KCD MAY 90 - FORMERLY FAR 52.2/9101(a))

The following is an example of a Contractor's release of claims clauses required to comply with the provisions of paragraph (h) of the CONTRACT CLAUSE titled "Payments Under Fixed-Price Construction Contracts":

RELEASE OF CLAIMS

The undersigned Contractor under contract dated _____, 2000, between the United States of America and said Contractor for the _____ located at _____, in accordance with paragraph (h) of the CONTRACT CLAUSE titled "Payments Under Fixed-Price Construction Contracts" of said contract, hereby releases the United States, its officers, agents, and employees from any and all claims arising under or by virtue of said contract or any modification or change thereof except with respect to those claims, if any, listed below:

(Here itemize claims and amounts due.)

1.7 PARTNERING

The Government intends to encourage the foundation of a cohesive partnership with the Contractor and its subcontractor. This partnership will be structured to draw on the strengths of each organization to identify and achieve mutual goals with the intent to complete the Contract within budget, on schedule and in accordance with plans and specifications. This partnership will be bilateral in makeup, and participation will be totally voluntary. Any cost associated with implementing this partnership will be agreed to by the Contractor and the Government, and will be shared equally with no change in Contract price. To implement this partnership initiative, it is anticipated that thirty (30) days after Notice to Proceed, a team building workshop will be conducted. Follow-up workshops will be held periodically throughout the duration of the Contract as agreed to by the Contractor and the Government.

1.8 PROSPECTIVE CONTRACTOR RESPONSIBILITY

Each bidder shall furnish, within 3 calendar days after receipt of request therefor, data which will show the bidder's ability to perform the work or services required by this Invitation for Bids. Such data shall include as a minimum: Bank certification of financial capability, or a financial statement not over 60 days old, which will be treated as confidential (if over 60 days old, a certificate shall be attached thereto stating that the financial condition is substantially the same or, if not the same, the changes that have taken place); names of commercial and financial reporting agencies from whom credit reports may be obtained; trade creditors; name and address of bonding company; business and construction experience; past record of performance of Government contracts; and construction plant and equipment available for this job, with resume of work in progress or other data that will assure that the bidder is in a position to perform the work within the time specified.

In addition, if the bid exceeds $1,000,000, the bidder shall furnish upon request, a certified statement listing:

(a) Each contract awarded to him within the preceding three-month period exceeding $1,000,000 in value with brief description of the contract.

(b) Each contract awarded to him within the preceding three-year period not already physically completed and exceeding $5,000,000 in value with brief description of the contract.

(c) If the prospective Contractor is a joint venture, each joint venture member will be required to submit the above defined certification. There shall also be furnished any other available information which will serve to substantiate the bidder's qualifications as a responsible prospective Contractor. (KCD APR 84)

1.9 PERFORMANCE OF WORK BY CONTRACTOR

Bidder's attention is directed to SPECIAL CLAUSE titled "Performance of Work by Contractor." The successful bidder will be required to furnish the Contracting Officer, a description of the work which he will perform with his own organization (e.g., earthwork, paving, etc.), the percentage of the total work this represents, and the estimated cost thereof. Such description of work to be performed by the Contractor's own organization shall be furnished to the Contracting Officer within 10 days after award of the contract.

1.10 LABORATORY AND TESTING FACILITIES

The Contractor shall provide and maintain all measuring and testing devices, laboratory equipment, instruments, transportation, and supplies necessary to accomplish the required testing. All measuring and testing devices shall be calibrated at established intervals against certified standards. The Contractor's measuring and testing equipment shall be made available for use by the Government for verification of their accuracy and condition as well as for any inspection or test desired pursuant to the CONTRACT CLAUSE titled "Inspection of Construction." The location of the laboratory shall be convenient to the site such that test results are available prior to proceeding with the next sequential phase of the work. (KCD)

1.11 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

(a) This provision specifies the procedure for determination of time extensions for unusually severe weather in accordance with the CONTRACT CLAUSE titled "Default: (Fixed Price Construction)." In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

(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.

(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.

(b) 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)	(5)	(3)	(3)	(4)	(5)	(4)	(3)	(5)	(3)	(3)	(6)

(c) 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 b, 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 titled "Default (Fixed Price Construction)." (ER 415-1-15)

1.12 WORKING HOURS

Working hours for this project will be limited to Monday through Friday, 7:30 a.m. to 4:30 p.m., except as follows: Work will not be permitted on weekends and Federal holidays. In unusual circumstances, such as when utility turn-off is required for an extended period of time, authorization for weekend or holiday work may be requested from the Contracting Officer; these instances must be coordinated well in advance, in writing. Likewise, utility turn-off of short duration or work which will disrupt normal operations or traffic flow must be scheduled at least 3 working days in advance and may require schedule changes to ensure that safety is maintained.

1.13 REQUIRED INSURANCE SCHEDULE

In accordance with CONTRACT CLAUSE titled "Insurance - Work On A Government Installation," the Contractor shall procure and maintain during the entire period of his performance under this contract the following minimum insurance.

Type	Amount
Workmen's Compensation State Statute	coverage complying with applicable
Employers' Liability	minimum amount of $100,000.00
General Liability on Comprehensive Form of Policy which includes, but is not limited to, insurance for all work required herein	minimum limits of $500,000 per occurrence for bodily injury
Comprehensive Automobile Liability	minimum limits of $200,000 per person and $500,000 per occurrence for bodily injury, and $20,000 per occurrence for property damage

(End of clause)

1.14 INTERRUPTIONS TO UTILITY SERVICES

A schedule showing the approximate times of interruptions of utility services and roads shall be submitted approximately 30 days in advance of interrupting services to make connections. Where it is necessary to interrupt services to make connections and the period of interruption will last more than 2 hours, the connections shall be performed on Saturday or Sunday, unless otherwise approved by the Contracting Officer. Final arrangements shall be made with the Contracting Officer at least 72 hours in advance of the scheduled times of interruptions.

1.15 CONTRACTOR-FURNISHED EQUIPMENT DATA

At or before 30 days prior to final inspection and acceptance of the work, the Contractor shall submit the data mentioned in the following subclauses.

(1) Equipment List. An itemized equipment list showing unit retail value and nameplate data including serial number, model number, size, manufacturer, etc., for all Contractor-furnished items of mechanical equipment, electrical equipment, and fire protection systems installed under this contract.

(2) Guarantees. A list of all equipment items which are specified to be guaranteed accompanied by a copy of each specific guarantee therefor. For each specific guaranteed item, a name, address, and telephone number shall be shown on the list for subcontractor who installed equipment, equipment supplier or distributor and equipment manufacturer. The completion date of the guarantee period shall correspond to the applicable specification requirements for each guaranteed item.

(3) Warranty Service Calls. The Contractor shall furnish to the Contracting Officer the names of local service representatives and/or Contractors that are available for warranty service calls and who will respond to a call within the time periods as follows: 4 hours for heating,

air-conditioning, refrigeration, air supply and distribution, and critical electrical service systems and food service equipment, and 24 hours for all other systems. The names, addresses, and telephone numbers for day, night, weekend, and holiday service responses shall be furnished to the Contracting Officer and also posted at a conspicuous location in each mechanical and electrical room or close to the unit.

1.16 DATE OF SAFETY AND HEALTH REQUIREMENTS MANUAL (EM 385-1-1)

(a) The date of the U.S. Army Corps of Engineers Safety and Health Requirements Manual in effect on the date of this solicitation is 3 September 1996. See Section 00700, Contract Clause titled "Accident Prevention."

(b) Section 06.I of EM 385-1-1 is deleted. Job hazard analysis for confined space entry procedures is still required, as per 01.A.09 of EM 385-1-1. OSHA Standards 29 CFR 1910.146 or 29 CFR 1926 shall apply.

(c) Before initiation of work at the job site, an accident prevention plan, written by the prime contractor for the specific work and hazards of the contract and implementing in detail the pertinent requirements of EM 385-1-1, will be reviewed and found acceptable by designated Government personnel.

1.17 COMPLIANCE WITH OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)

The Contractor shall comply with OSHA standards as well as the most current edition of the Corps of Engineers General Safety Requirements Manual (EM 385-1-1). The OSHA standards are subject to change and such changes may affect the Contractor in his performance under the contract. It is the Contractor's responsibility to know such changes and effective dates of changes.

1.18 CONSTRUCTION EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE

Whenever a modification or equitable adjustment of contract price is required, the Contractor's cost proposal for equipment ownership and operating expenses shall be as set forth in SPECIAL CLAUSE titled "Equipment Ownership and Operating Expense Schedule." A copy of EP 1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" dated August 1995 can be ordered from the Government Printing Office (GPO) by calling Telephone No. 202-512-1800.

1.19 SHOP DRAWINGS

The Contractor's attention is directed to clause "Specifications and Drawings for Construction" of the Contract Clauses.

1.20 SUBMITTALS

(a) Submittal Procedures. See Division One SECTION: SUBMITTAL PROCEDURES.

(b) Shop Drawings shall be submitted in ample time to secure approval prior to the time the items covered thereby are to be delivered to the site. ENG Form 4025 and 4026 shall be used for the transmittal of shop drawings. Unless otherwise specified, shop drawings shall be submitted not less than 30 days before commencement of fabrication of fabricated items and not less than 15 days before delivery of standard stock manufactured items. Where materials are stock with the manufacturer, catalog data, including

specifications and full descriptive matter, may be submitted as shop drawings. When catalog includes nonapplicable data, the applicable data shall be clearly designated and identified by item number, item name, and name of manufacturer. Shop drawings submitted (including initial and final submittals) shall be reproductions on high quality paper with clear and legible print. Drawings shall generally be bordered a minimum of one inch and trimmed to neat lines and unless otherwise specified, the minimum scale shall be 3/8-inch to the foot. Shop drawings quality will be subject to approval. Each shop drawing, including catalog data, shall be identified with a title block including the name of Contractor, contract number, name and location of project, and name of item of work or structure to which the shop drawing applies. Material fabricated or delivered to the site before approved shop drawings have been returned to the Contractor will be subject to rejection. NO CONSTRUCTION OR INSTALLATION SHALL BE DONE FOR ANY ITEM REQUIRING SHOP DRAWINGS, UNTIL ALL SHOP DRAWINGS FOR THAT ITEM HAVE BEEN APPROVED.

(c) As-Built Shop Drawings: Upon completion of the work under this contract, the Contractor shall furnish five complete sets of prints or one complete set of reproducibles of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the equipment is completed and accepted. The quality of the reproducibles and prints is subject to approval.

(d) Purchase Orders: Each purchase order issued by the Contractor or his subcontractors for materials and equipment to be incorporated into the project, shall be maintained on file at the Contractor's field office for inspection and review by Government representatives. Each purchase order shall (1) be clearly identified with applicable DA contract number, (2) carry an identifying number, (3) be in sufficient detail to identify the material being purchased, (4) indicate a definite delivery date, and (5) display the DMS priority rating. At the option of the Contractor, the copies of the purchase orders may or may not indicate the price of the articles purchased. (MRD Ltr 22 Oct 74)

1.21 SPECIAL REFERENCES

(a) Shop Drawings. Bidder's attention is directed to SPECIAL CLAUSE titled "Shop Drawings." The basic requirements for Shop Drawings are set forth in the CONTRACT CLAUSES and SPECIAL CLAUSES.

(b) Approved Equal. Bidder's attention is directed to SPECIAL CLAUSE titled "Approved Equal."

(c) Payment to Subcontractors. Bidder's attention is directed to SPECIAL CLAUSE titled "Payments to Subcontractors."

1.22 DIFFERENCES IN DRAWINGS

In addition to the provisions of CONTRACT CLAUSE paragraph "Specifications and Drawings for Construction," the structural drawings shall govern in cases where they differ from the architectural drawings.

1.23 DAMAGE TO WORK (1966 MAR OCE)

The responsibility for damage to any part of the permanent work shall be as set forth in the CONTRACT CLAUSE titled "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 titled, "Changes," of the contract, 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.

1.24 WORK ADJACENT TO ROADS AND HIGHWAYS

Where the construction work is on or adjacent to, or involves hauling over public or private roads, streets, or highways, all herein referred to as "roads," the said roads shall, except as otherwise specified or directed, be kept open for traffic at all times during the construction period. Further, the Contractor shall, during said construction, provide, erect and maintain warning signs, lanterns or torches or other safety devices and, when necessary, provide flagmen for protection of traffic to the satisfaction of the Contracting Officer and local authorities. The Contractor shall keep the right-of-way of the roads free of debris that might be caused to accumulate thereon by his operations, and upon completion of the work, shall clean up the said roads and repair any damage to the roads occasioned by his operations under this contract to the satisfaction of the Contracting Officer and local authorities having jurisdiction. The drainage from the roads shall not be obstructed by the construction work. The Contractor shall be responsible for obtaining and paying for all permits required for operation on all roads.

1.25 APPROVED EQUAL

The drawings and the TECHNICAL PROVISIONS of these specifications may, in some instances, refer to certain items of equipment, material, or article by trade name. References of this type shall not be construed as limiting competition, but shall be regarded as establishing a standard of quality. In this respect, the Contractor's attention is directed to CONTRACT CLAUSE titled "Material and Workmanship."

1.26 SCHEDULE OF WORK

The Contractor's attention is directed to CONTRACT CLAUSE titled "Schedule for Construction Contracts," wherein 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.

1.27 UPKEEP OF ROADWAY AREAS WITHIN A MILITARY INSTALLATION WHICH THE CONTRACTOR USES

In addition to the requirements in CONTRACT CLAUSE titled "Operations and Storage Areas," the Contractor shall comply with the following requirements: Where the construction work is on or adjacent to, or involves hauling over public roads, streets, or highways located on a

military installation, all herein referred to as "roads," the said roads shall except as otherwise specified or directed, be kept open for traffic at all times during the construction period. The Contractor shall keep the roads including adjacent construction site free of debris including litter, waste construction material, mud etc., that might be caused to accumulate thereon by his operations, and upon completion of the work, shall clean up the said roads and construction site and repair any damage occasioned with his operations under this contract to the satisfaction of the Contracting Officer. The drainage from the roads shall not be obstructed by the construction work.

1.28 PROTECTION OF UTILITY LINES

(a) It shall be the Contractor's responsibility to protect all existing utility lines from damage during excavation for utilities systems. Any damage resulting to existing utility systems shall be repaired by the Contractor, to the satisfaction of the contracting officer, at no additional cost to the Government.

(b) All requests for access and/or locations must be made through the Contracting Officer's Representative (COR) or Resident Engineer. The Director of Public Works will work directly with the Resident Engineer to provide timely information to the Contractor.

(c) Not less than 3 or more than 10 workdays prior to the actual day of excavation on each site, the Contractor shall contact Kansas One-Call System, Inc., Toll Free 1-800-344-7233 and obtain a Kansas Dig-Safe Ticket Number. Immediately after obtaining a Kansas Dig-Safe Number the Contractor shall contact Fort Riley Dig-Safe Coordinator at Public Works, Building 337, Telephone 1-785-239-8187, FAX 1-785-239-8188, and accomplish the items listed below. No exceptions to this policy will be tolerated. The Contractor will be held liable for all costs incurred by various underground utility owners for repairs to damaged underground utilities resulting from failure to comply with this procedure.

(1) Provide Kansas One-Call System Ticket Number.

(2) Provide company name, name and telephone number of point of contact.

(3) Provide a site drawing with measurements from nearest building showing depth and nature of work:

(4) Mark the area to be dug with white paint.

1.29 MODIFICATIONS PRIOR TO DATE SET FOR OPENING BIDS

The right is reserved, as the interest of the Government may require, to revise or amend the specifications or drawings or both prior to the date set for opening bids. Such revisions and amendments, if any, will be announced by an amendment or amendments to this Invitation for Bids. If the revisions and amendments are of a nature which requires material changes in quantities or prices bid or both, the date set for opening bids may be postponed by such number of days as in the opinion of the issuing officer will enable bidders to revise their bids. In such cases, the amendment will include an announcement of the new date for opening bids. (KCD APR 84)

1.30 UNEXPECTED HAZARDOUS SUBSTANCES

In the event that suspected hazardous substances are revealed during construction activities, all such construction activities in the immediate area shall be immediately suspended. Hazardous substances for purposes of this specification only, shall be defined as CERCLA hazardous substances, infectious or radioactive wastes, asbestos or oil. The Contractor shall leave the materials undisturbed and shall immediately report the find to the Contracting Officer's Representative (COR) so that proper authorities can be notified. The Contractor shall not resume construction activities in the vicinity of the suspected hazardous substances until written clearance is received from the COR. Identification and removal of any such materials will be conducted in accordance with all Federal, state and local environmental laws and regulations according to the CONTRACT CLAUSE titled "Differing Site Conditions."

1.31 UNEXPECTED DISCOVERY OF ASBESTOS ON CONSTRUCTION (RENOVATION AND DEMOLITION)

The buildings and areas to be renovated or demolished have been surveyed for the presence of asbestos-containing materials. This survey is not a warranty that asbestos-containing materials are either not present or limited to the amounts found in the survey. Should suspected asbestos-containing material be encountered, the Contractor shall promptly, and before the conditions or the substance encountered is disturbed, give a written notice to the Contracting Officer of the suspected asbestos-containing material conditions encountered. As directed by tee Contracting Officer, the Contractor shall remove and dispose of any and all asbestos-containing material as necessary to accomplish the required work which shall be performed in accordance with all pertinent local, state, and federal laws. An equitable adjustment will be made to the Contractor in accordance with the CONTRACT CLAUSE entitled "Changes", for the additional work directed by the Contracting Officer.

1.32 TIMBER DISPOSAL

All timber, logs, stumps, roots, brush, and small branches, and all cedar, pine, and cottonwood shall be disposed of in the habitat area identified on the cover sheet map as at the Habitat Brush Site. Other refuse from the clearing and grubbing operations, and rotten wood or diseased trees identified by and marked by the installation DES shall be disposed of in the construction debris land fill (Campbell Hill Road), 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.

1.33 FORT RILEY CONSTRUCTION DEMOLITION DEBRIS (C/D) LANDFILL OPERATIONS

The Fort Riley Construction Demolition Debris (CD) landfill is located on Campbell Hill Road approximately one mile north of Camp Funston. There is no charge for using the landfill. Delivery vehicles shall be identified with contractor signs on both sides of the vehicle and must provide the contract number. The CD landfill will have an attendant on duty and be open for normal operations (excluding Federal Holidays) Monday-Friday, 0730-1600. Only construction demolition debris materials will be accepted. Acceptable materials are posted on a board at the entrance. Asbestos materials deliveries require a call for an appointment 24 hours in advance of delivery. Telephone (785) 761-5002. All transformers and light ballasts shall be turned in to Building 339 within the PW maintenance yard on Main Post. Light ballasts shall have all wires cut off. POC is Don Wainwright, telephone (785) 239-3832. Any salvageable items shall be

turned in to the Directorate of Environment and Safety (DES) Recycle Center, Building 1980, in Camp Funston. POC is the Solid Waste Program Manager, DES, telephone (785) 239-2860.

1.34 Site Specific Access Control - Fort Riley

Fort Riley is implementing physical security measures in the form of access control. These measures apply to all contractors and their employees. Fort Riley requires each vehicle to have either a temporary or permanent identification marker attached. It shall be the contractor's responsibility to monitor and control all company and employee vehicle identification markers and to comply with Fort Riley's requirements for issuing and returning these identification markers.

At a minimum, Fort Riley requires valid vehicle insurance, valid vehicle registration and a current driver's license. Rental cars should carry the rental agreement in the car when entering Fort Riley.

Identification cards shall be visibly worn at all time while on the installation.

The contractor shall be responsible for complying with all security conditions as determined by Fort Riley and shall be responsible for changes in conditions as they occur.

1.35 KANSAS SALES AND USE TAX

In accordance with FAR clause 52.229-3, notice is given that the contract price excludes the Kansas sales tax and compensating (use) tax on all sales of tangible personal property and materials purchased by the Contractor or subcontractors for the construction of projects, including repairing or remodeling facilities, for the United States. In accordance with Kan. Stats. Anno., sec. 79-3606(e), the Contracting Officer will obtain from the State and furnish to the Contractor an exemption certificate for this project for use by the Contractor and subcontractors in the purchase of materials for incorporation in the project and of services. The Contractor and the subcontractors shall furnish the number of such certificate to all suppliers from whom such purchases are made, and the suppliers shall execute invoices covering the same bearing the number of such certificate. Pursuant to a 1977 Amendment to K.S.A., 1976 Supp., 79-3606(e), effective 1 July 1977, the Contractor is required to retain all invoices for a period of five (5) years during which time these invoices are subject to audit by the Kansas Director of Taxation. Upon completion of the project, the Contractor shall complete the Project Completion Certification (Form STD 77, Rev. 6/77) in duplicate returning one copy to the Contracting Officer, and forwarding the other to the Kansas Director of Taxation. (KCD)

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

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DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SCOPE: This section provides a summary of submittals which are required in various sections of the specifications, and is provided for the convenience of the Contractor and the Government in the administration of the Contract. Any omission of a submittal in this summary, but required elsewhere in the specifications, shall not relieve the Contractor of the responsibility of furnishing the requested submittal.

1.2 APPLICABLE PUBLICATIONS: Not Used.

1.3 SUBMITTALS: Not Used.

1.4 DEFINITION: The term "submittal" includes, but is not limited to: Accident Prevention Plan; Quality Control Plan; catalog cuts and samples; certificates of compliance; certified lists of major equipment and materials; installation, application, and finishing instructions; keying schedules; manufacturer's descriptive literature; operation and maintenance instructions; repair parts lists; shop drawings; test reports and results; batch and weigh tickets; applications for authorizations or permits; and other related information to be furnished by the Contractor to describe, in detail, specific portions of the work and materials required by the plans and specifications.

1.4.1 Certified Lists of Materials: Certified lists of major materials shall include names of manufacturers; brand names, model numbers, stock numbers, or other designations; item descriptions; cross-references to applicable publications; and certification by manufacturers that materials being supplied meet or exceed the requirements specified. Current, dated manufacturer's descriptive literature sufficient to determine conformance with the requirements specified may be submitted in lieu of written certification by manufacturers.

1.4.2 Installation Instructions: Manufacturer's written installation, application and finishing instructions required in various sections of the specifications includes all installation, application and finishing instructions, recommendations, suggestions, and guidance whether published separately, noted on the manufacturer's shop drawings, or printed on the product or its packaging.

1.4.3 Samples: Samples of materials proposed for use in the project shall be furnished to the Contracting Officer, if requested.

1.4.4 Test Reports: Test reports or other technical analyses demonstrating that materials proposed for use in the project conform to the requirements specified shall be furnished to the Contracting Officer, if requested.

1.4.5 Applications for DA Radiation Authorizations or Permits: Do not operate any testing equipment utilizing a radiation source without obtaining a Radiation Permit from the Fort Riley Radiation Protection Officer. Prepare and submit DA Form 3337, Application for Department of the Army Radiation Authorization or Permit, 30 days prior to use of radiation source testing equipment.

1.5 GENERAL: Submittals shall be adequate, in themselves, to determine conformance with the Contract plans and specifications. Certificates of compliance submitted shall be notarized. Coordinate all submittals and review them

for accuracy, completeness, and compliance with contract requirements, and indicate approval thereon as evidence of such coordination and review. Submittals submitted to the Contracting Officer without evidence of the Contractor's approval will be returned without action for resubmission. The Contracting Officer shall indicate his approval or disapproval of the submittals, and if not approved as submitted, indicate his reasons for disapproval. Any materials for which a submittal is required shall not be purchased or incorporated into the work without prior approval of the submittals. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in shop drawings, nor from responsibility for complying with the requirements of this Contract, except with respect to variations described and approved in compliance with the following paragraph.

1.6 VARIATIONS: If submittals show variations from the Contract requirements, the Contractor shall describe the variations in writing, separate from the basic submittal document, at the time of submission.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 SUBMITTAL SUBMISSION:

3.1.1 Where to Submit: Submit submittals to the Contracting Officer, Directorate of Contracting, Building 802, P.O. Box 2248, Fort Riley, Kansas 66442-2248.

3.1.2 When to Submit: All submittals for a project, with the exception of the Accident Prevention Plan and Quality Control Plan, shall be complete and submitted at one time within 10 days after receipt of the Notice to Proceed (or first Delivery Order). The Contracting Officer may, at the request of the Contractor, waive the 10 day submission requirement for materials which will not be incorporated into the work until a later date. Submit the Accident Prevention Plan and Quality Control Plan not later than the Preconstruction (or Preperformance) Conference. The Notice to Proceed (or first Delivery Order) will not be issued until the plans have been approved by the Government. The approved plans shall be implemented not later than the contract start date. The Contractor shall resubmit the plans within 5 working days prior to any proposed changes in the plans.

3.1.3 What to Submit: All submittals shall be accompanied by properly filled out ENG Form 4025-R, Transmittal of Shop Drawings, Equipment Data, Material Samples, or Manufacturer’s Certificates of Compliance and ENG Form 4288-R, Submittal Register. Copies of both forms are available from the Contracting Officer. Submittals shall be grouped together by division of work and submitted on one Material Approval Submittal Form for each division. Submit for approval four (4) copies of all submittals except physical samples of materials and applications for DA Radiation Authorizations or Permits. Only one item of a physical material sample is required for submission. Eight (8) copies of DA Form 3337, Application for DA Radiation Authorization or Permit shall be submitted. Three (3) sets of submittals shall be retained by the Contracting Officer and one (1) set shall be returned to the Contractor. The one (1) physical material sample submitted shall be retained by the Contracting Officer unless stated otherwise.

3.1.4 Submittal Register: Submit two (2) copies of updated ENG 4288-R, Submittal Register with each invoice.

3.2 AS-BUILT DRAWINGS SUBMISSION: Prepare and submit as-built drawings in accordance with SECTION 01720, AS-BUILT DRAWINGS.

3.3 SUBMITTAL SUMMARY: Submittals required by various sections of the specifications are summarized as follows:

Referenced Section and Paragraph or Sheet Number	**Description of Submittal**
Section 01010, Paragraph 1.3	Accident Prevention Plan and Quality Control Plan.
Section 01110, Paragraph 1.3	Statement of Non-Compliance, Product Data, Samples; Design Data, Test Reports and Certifications; and Quality Control Submittals.
Section 01440, Paragraph 1.3	Quality Control Plan and Quality Control Reports.
Section 01720, Paragraph 1.3	As-Built Drawings.
Section 02050, Paragraph 1.3	Receipts and DD Forms 1348-1.
Section 02080, Paragraph 1.3	Permits and Notifications, Removal and Disposal Plan, List of Materials, List of Equipment, Test Results, Proof of Participation and Accreditation, Proof of License and/or Registration, Proof of Employee Certification, and Proof of Disposal.
Section 02081, Paragraph 1.3	Permits and Notifications, Lead Hazard Reduction Plan, List of Materials, List of Equipment, Test Results, Proof of Participation and Accreditation, Proof of License and/or Registration, Proof of Employee Training and Medical Examinations, and Proof of Disposal.
Section 02223, Paragraph 1.3	Test Results and Application for DA Radiation Authorization or Permit
Section 02510, Paragraph 1.3	List of Materials, Batch Tickets, Job-Mix Formula, Test Results and Application for DA Radiation Authorization or Permit
Section 02520; Paragraph 1.3	List of Materials and Batch Tickets
Section 02930, Paragraph 1.3	List of Materials and Application Instructions
Section 03300, Paragraph 1.3	List of Materials and Batch Tickets
Section 03700; Paragraph 1.3	List of Materials and Installation Instructions
Section 04200, Paragraph 1.3	List of Materials, Samples and Batch Tickets

Section 04400; Paragraph 1.3	List of Materials, Shop Drawings, Samples and Batch Tickets
Section 05060, Paragraph 1.3	Welding Procedure Specifications, Procedure Qualification Test Records and Welder and Tacker Qualification Test Records
Section 05120, Paragraph 1.3	List of Materials, Installation Instructions and Shop Drawings
Section 05500, Paragraph 1.3	List of Materials, Installation Instructions and Shop Drawings
Section 05501, Paragraph 1.3	List of Materials and Installation Instructions
Section 05510, Paragraph 1.3	List of Materials, Installation Instructions and Shop Drawings
Section 06100, Paragraph 1.3	List of Materials, Installation Instructions and Samples
Section 06400; Paragraph 1.3	List of Materials, Samples, Installation Instructions and Shop Drawings
Section 07210, Paragraph 1.3	List of Materials and Installation Instructions
Section 07220; Paragraph 1.3	List of Materials, Installation Instructions and Shop Drawings
Section 07242, Paragraph 1.3	List of Materials, Samples, Installation and Maintenance Instructions
Section 07270, Paragraph 1.3	List of Materials and Installation Instructions
Section 07535, Paragraph 1.3	List of Materials, Installation Instructions and Shop Drawings
Section 07600, Paragraph 1.3	List of Materials, Installation Instructions and Shop Drawings
Section 07710, Paragraph 1.3	List of Materials, Installation Instructions and Shop Drawings
Section 07820, Paragraph 1.3	List of Materials and Installation Instructions
Section 07920, Paragraph 1.3	List of Materials and Installation Instructions
Section 08110, Paragraph 1.3	List of Materials, Installation Instructions and Shop Drawings
Section 08210, Paragraph 1.3	List of Materials, Installation Instructions and Shop Drawings

Section 08410, Paragraph 1.3	List of Materials, Samples, Installation Instructions and Shop Drawings
Section 08520, Paragraph 1.3	List of Materials, Installation Instructions and Shop Drawings
Section 08700, Paragraph 1.3	List of Materials, Installation Instructions and Keying Schedule
Section 08810, Paragraph 1.3	List of Materials and Installation Instructions
Section 09100; Paragraph 1.3	List of Materials and Shop Drawings
Section 09200; Paragraph 1.3	List of Materials and Application and Finishing Instructions
Section 09250, Paragraph 1.3	List of Materials and Application and Finishing Instructions
Section 09300, Paragraph 1.3	List of Materials, Samples and Installation Instructions
Section 09330, Paragraph 1.3	List of Materials, Samples and Installation Instructions
Section 09510, Paragraph 1.3	List of Materials and Installation Instructions
Section 09660, Paragraph 1.3	List of Materials, Samples and Installation Instructions
Section 09680, Paragraph 1.3	List of Materials, Samples and Installation Instructions
Section 09725; Paragraph 1.3	List of Materials, Samples, Installation Instructions and Work Sample
Section 09835; Paragraph 1.3	List of Materials, Samples, Application Instructions and Work Sample
Section 09900, Paragraph 1.3	List of Materials, Samples and Application Instructions
Section 10160, Paragraph 1.3	List of Materials, Samples and Installation Instructions
Section 10260, Paragraph 1.3	List of Materials, Samples and Installation Instructions
Section 10440, Paragraph 1.3	List of Materials, Installation Instructions, Samples and Shop Drawings
Section 10505, Paragraph 1.3	List of Materials, Samples and Installation Instructions
Section 10520, Paragraph 1.3	List of Materials, Samples and Installation Instructions

Section 10650, Paragraph 1.3	List of Materials, Installation Instructions, Samples and Shop Drawings
Section 10800, Paragraph 1.3	List of Materials and Installation Instructions
Section 11132, Paragraph 1.3	List of Materials and Installation Instructions
Section 11160, Paragraph 1.3	List of Materials, Installation Instructions and Shop Drawings
Section 11400, Paragraph 1.3	List of Materials, Samples, Installation, Operation, and Maintenance Instruction, Utility Equipment Drawings, Product Data, Coordination With Owner Furnished Items, Shop Drawings, Plan Elevations, Departures and Electrical Diagrams
Section 12510, Paragraph 1.3	List of Materials, Samples and Installation Instructions
Section 12511; Paragraph 1.3	List of Materials, Samples and Installation Instructions
Section 12690; Paragraph 1.3	Product Data and Samples
Section 14240, Paragraph 1.3	Data, Drawings, Instructions, Statements, Reports, Samples, Records and Operation and Maintenance Manuals
Section 15250; Paragraph 1.3	List of Materials and Installation Instructions.
Section 15400; Paragraph 1.3	List of Materials; Samples; Installation, Operation, and Maintenance Instructions; Shop Drawings; and As-Built Drawings.
Section 15488; Paragraph 1.3	List of Materials; Shop Drawings; and As-Built Drawings.
Section 15510; Paragraph 1.3	List of Materials; Installation Instructions; Shop Drawings; and As-Built Drawings.
Section 15530; Paragraph 1.3	List of Materials; Shop Drawings; and As-Built Drawings.
Section 15550; Paragraph 1.3	List of Materials; Installation, Operation, and Maintenance Instructions; Shop Drawings; As-Built Drawings; and Test Results.
Section 15650; Paragraph 1.3	List of Materials; Installation, Operation, and Maintenance Instructions; Shop Drawings; As-Built Drawings; System Performance Tests; and Certificates.

Section 15850; Paragraph 1.3	List of Materials; Installation, Operation, and Maintenance Instructions; Shop Drawings; As-Built Drawings; and Test Results.
Section 15880; Paragraph 1.3	List of Materials; Installation Instructions; Shop Drawings; As-Built Drawings; and Test Results.
Section 15971; Paragraph 1.3	Data: Equipment Data; System Descriptions and Analyses, Software; System Overall Reliability Calculations; Training Data; Data Entry Forms. Drawings: System Drawings Statements: Factory Testing; Site Testing; Performance Verification Testing and Endurance Testing; Commissioning Procedures. Reports: Test Reports; Performance Verification and Endurance Report; Control System Calibration, Adjustments, and Commissioning. Operation and Maintenance Manuals: Operation and Maintenance Manuals; Functional Design Manual; Hardware Manual; Software Manual; Operator's Manual; Maintenance Manual.
Section 15990; Paragraph 1.3	Testing and Balancing Reports: Preliminary Report, Final Report; Certificates.
Section 16050; Paragraph 1.3	List of Materials, Installation, Operation and Maintenance Instructions; Shop Drawings; As-Built Drawings; and Circuit Program.
Section 16400; Paragraph 1.3	List of Materials; Installation, Operation and Maintenance Instructions; Shop Drawings; As-Built Drawings; and Transformer Record Card.
Section 16510; Paragraph 1.3	List of Materials; Samples; Installation Instructions; Shop Drawings; and As-Built Drawings.
Section 16520; Paragraph 1.3	List of Materials; Samples; Installation Instructions; Shop Drawings; and As-Built Drawings.
Section 16721; Paragraph 1.3	List of Materials; Installation, Operation, and Maintenance Instructions; Shop Drawings; Qualifications; Spare Parts; Test Reports; and As-Built Drawings.

Section 16722; Paragraph 1.3	List of Materials; Installation; Operation and Maintenance Instructions; Shop Drawings; Qualifications; Spare Parts; List of Zones; Test Reports; and As-Built Drawings.
Section 16740; Paragraph 1.3	List of Materials; Certification; Qualifications; Installation, Operation and Maintenance Instructions; Shop Drawings; Test Plan; Test Reports; and As-Built Drawings
Section 16775; Paragraph 1.3	Product Data Sheets and List of Materials; Installation, Operation and Maintenance Instructions; Shop Drawings; As-Built Drawings.
Section 16780; Paragraph 1.3	List of Materials; Installation, Operation and Maintenance Instructions; Shop Drawings; As-Built Drawings.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01440

CONSTRUCTION QUALITY MANAGEMENT
CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 SCOPE: This section sets forth requirements for construction quality management - contractor quality control.

1.2 APPLICABLE PUBLICATIONS: Not Used.

1.3 SUBMITTALS:

1.3.1 Quality Control Plan: Submit a Quality Control (QC) Plan.

1.3.2 Quality Control Reports: Submit two legible copies of Quality Control Reports daily.

1.4 QUALITY CONTROL PLAN:

1.4.1 General: Develop, implement, and maintain a quality control system which meets or exceeds the requirements of Contract Clause FAR 52.246-0012 entitled: INSPECTION OF CONSTRUCTION. Identify personnel, lines of authority, procedures, instructions, records, and forms to be used in the plan. Implement the approved plan not later than the contract start date.

1.4.2 Quality Control Plan: Include the following, as a minimum:

1.4.2.1 A description of the QC organization, including chart showing lines of authority and acknowledgment that the QC staff shall report to the project manager or someone higher in the Contractor's organization.

1.4.2.2 The name, qualifications, duties, responsibilities and authorities of each person assigned a QC function.

1.4.2.3 A copy of the letter to the QC manager signed by an authorized official of the firm, which describes the responsibilities and delegates the authorities of the QC manager shall be furnished.

1.4.2.4 Procedures for managing submittals including those of subcontractors, offsite fabricators, suppliers and purchasing agents.

1.4.2.5 Procedures for inspection of all work and materials.

1.4.2.6 Procedures for inspection of all tests.

1.4.2.7 Procedures for corrective action without dependence upon Government direction.

1.4.2.8 Procedures for reporting including proposed reporting formats.

1.4.3 Coordination Meeting: Prior to the start of construction, the Contractor shall schedule and meet with the Contracting Officer and discuss the QC system. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the QC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's inspection and control

with the Government's inspection. Minutes of the meeting shall be prepared by the Contractor and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may also be occasions when subsequent conferences will be called to reconfirm mutual understandings.

1.5 QUALITY CONTROL ORGANIZATION:

1.5.1 Quality Control System Manager: Identify an individual, within the organization at the site of the work, who will be responsible for overall QC management and have the authority to act in all QC matters for the Contractor. The QC manager will be approved by the Contracting Officer and changed if the QC manager is unable or unwilling to perform his duties as prescribed.

1.5.2 Personnel: Maintain a staff under the direction of the QC manager to perform all QC activities. The size of the staff during any specific work period may vary to cover work phase needs, shifts, and rate of placement. Personnel on the staff shall be fully qualified by experience and technical training to perform their assigned responsibilities and be directly hired by and work for the prime Contractor. NOTE: Minimum staffing and qualifications may be specified in the contract.

1.5.3 Personnel Qualifications: QC personnel shall be trained and experienced in QC matters and fully capable of performing their QC functions.

1.6 CONTROLS: Contractor QC is the means by which the Contractor assured himself that his construction complies with the requirements of the contract plans and specifications. The controls shall be adequate to cover all construction operations, including both onsite and offsite fabrication, and will be keyed to the proposed construction sequence. The controls shall include at least three phases of inspection for all definitive features of work as follows:

1.6.1 Preparatory Inspection: This shall be performed prior to beginning any work on any definable feature of work. It shall include a review of contract requirements, a check to assure that all materials and/or equipment have been tested, submitted and approved; a check to assure that provisions have been made to provide control testing; examination of the work area to ascertain that all preliminary work has been completed; and a physical examination of materials, equipment and sample work to assure that they conform to approved shop drawings or submittal data and that all materials and/or equipment are on hand. The Contracting Officer's Representative (COR) shall be notified at least 48 hours in advance of the preparatory inspection and such inspection shall be made a matter of record in the QC documentation as required below. Subsequent to the preparatory inspection and prior to commencement of work, the Contractor shall instruct each applicable worker as to the acceptable level of workmanship required in his QC plan in order to meet contract specifications.

1.6.2 Initial Inspection: This shall be performed as soon as a representative portion of the particular feature of work has been accomplished. The inspection shall include examination of the quality of workmanship and a review of control testing for compliance with contract requirements. The COR shall be notified at least 48 hours in advance of the initial inspection and such inspection shall be made a matter of record in the QC documentation as required below.

1.6.3 Follow-up Inspections: These shall be performed daily, to assure continuing compliance with contract requirements. Such inspections shall be made a matter of record in the QC documentation are require below. Final follow up

inspections shall be conducted and test deficiencies corrected prior to the addition of new features of work.

1.7 TESTS:

1.7.1 Testing Procedures: The Contractor shall perform the tests specified or as required to verify that control measures are adequate to provide a product which conforms to contract requirements. The Contractor shall procure the services of an independent testing laboratory or establish an testing laboratory at the project site. Laboratory facilities must be approved by the Contracting Officer. A list of tests which the Contractor understands he is to perform shall be furnished as a part of the QC plan to the Contracting Officer. The list shall give the test name, specification paragraph containing the test requirements, and the personnel and laboratory responsible for each type of test. The Contractor shall perform the following activities and record and provide the following data:

1.7.1.1 Verify that testing procedures comply with contract requirements.

1.7.1.2 Verify that facilities and testing equipment are available and comply with testing standards.

1.7.1.3 Check test instrument calibration data against certified standards.

1.7.1.4 Verify that recording forms, including all of the test documentation requirements, have been prepared.

1.7.2 Testing:

1.7.2.1 Capability Check: The COR will have 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.

1.7.2.2 Capability Recheck: If the selected laboratory fails the capability check, the Contractor will be assessed a charge of $750 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.

1.7.2.3 Project Laboratory: The COR will have 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.

1.7.2.4 Transportation of Samples for Testing: Costs incidental to the transportation of samples or materials will be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineer Division Laboratory, at the following address:

1.7.2.4.1 For Delivery By Mail:

Missouri River Division Laboratory
420 South 18th Street
Omaha, Nebraska 68102

1.7.2.4.2 For Other Deliveries:

Same as above.

1.8 COMPLETION INSPECTION: At the completion of all work or any increment thereof established by a completion time stated elsewhere in the specifications, the QC manager shall conduct a completion inspection of the work and develop a "punch list" of items which do not conform to the approved plans and specifications. Such a list shall be included in the QC documentation, as required by paragraph 1.9 below, and shall include the estimated date by which the deficiencies will be corrected. The QC manager or his staff shall make a second completion inspection to ascertain that all deficiencies have been corrected and so notify the COR. The completion inspection and any deficiency corrections required by this paragraph will be accomplished within the time stated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates. The completion inspection and second inspection shall be performed before the work is turned over to the Public Works Contract Inspectors as being complete.

1.9 DOCUMENTATION:

1.9.1 The Contractor shall maintain a daily record of all QC activities. These records shall be maintained at the worksite throughout the term of this contract and be made available to the Contracting Officer at all times.

1.9.2 Records shall include a description of trades working on the project, number of personnel working, weather conditions encountered, any delays encountered, and acknowledgment of deficiencies noted along with the corrective actions taken on current and previous deficiencies. Records shall also include factual evidence that required activities or tests have been performed, including, but not limited to, the items below:

1.9.2.1 Type and number of QC inspections and tests accomplished.

1.9.2.2 Results of QC inspections and tests.

1.9.2.3 Nature of defects, causes for rejection, etc.

1.9.2.4 Proposed remedial action.

1.9.2.5 Corrective actions taken.

1.9.3 A sample QC Report form may be found at the end of this section. The Contractor may use this form or a form of his own design so long as it contains the same information.

1.10 NOTIFICATION OF NONCOMPLIANCE: The Contracting Officer will notify the Contractor of any noncompliance with the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his representative at the site of the work, 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 any such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

DAILY CONSTRUCTION QUALITY CONTROL REPORT
(Contractor's Name and Address)

Contract No: DAKF19- **Date:** **Report No:**

Description and Location of Work:

Weather: **; Temperature: Min** **Max** **; Precip: Inches** **Type**

Contractor/Subcontractors: (Areas of responsibility and labor count for each.)

a.
b.
c.
d.
e.
f.

Equipment Data: (Indicate Items of construction equipment, other than hand tools, at the job site, and whether or not used.)

Work Performed Today: Estimated % Complete

Results of Surveillance: (Include satisfactory work inspected, deficiencies found, corrective actions taken, and when corrective actions are completed and reinspected.)

Material Inspected: (Include any material arrived on site, also material incorporated in the construction.)

DAILY CONSTRUCTION QUALITY CONTROL REPORT - Page 2
(Contractor's Name and Address)

Tests Required, Performed and Results:

Instructions Received or Given: (Include any instructions received from, or given to, Government representatives or other Government contractors.)

Remarks: (Include any item not addressed in other sections, problems with plans or specifications, any disputes.)

Safety: (Note all unsafe conditions, equipment, personnel, surroundings and corrective actions, also safety meetings.)

Correspondence:

Documents on Work Site	yes	no	Submittal Number	Date Sent	Date Received	Approved yes	Approved no
Plans							
Specifications							
Manufacturer's Installation Instructions							
Shop Drawings							
Permits							
Other:							

Signature of Quality Control Inspector _____

Signature of Quality Control Manager _____

/

SECTION 01500A

TEMPORARY CONSTRUCTION FACILITIES
02/97

PART 1 GENERAL

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

If determined that existing utility systems and supplies are adequate or the needs and use of the Contractor as well as the Government, all reasonably required amounts of water, gas and electricity will be available to the Contractor.

1.2.1 Payment for Utility Services

The amount of each utility service (gas and electricity) consumed by the Contractor shall be charged to and paid for by the Contractor. The rates charged will be Rate B, the Government's resale rates charged to commercial users. Consumption shall be determined by meters. The Contractor shall contact the Public Works Utilities Sales Office at 785-239-6152 prior to making any connection and/or use of utilities.

1.2.2 Meters and Temporary Connections

The Contractor shall, at his own expense, make all permanent and temporary connections to the existing distribution system; this includes meters. (Water service does not require a meter.) The Contractor shall remove all temporary services and connections prior to final acceptance of the job.

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 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.

1.2.5 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 36 by 48 inches 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 6 foot 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 12 feet in width, 16 feet in length and have a minimum of 7 feet 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 20 degrees F below the outside temperature when the outside temperature is 95 degrees F,

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

1.6.1 Resident Engineer's Office

The Contractor shall provide the Government Resident Engineer with an office, approximately 200 square feet in floor area, located where directed and providing space heat, electric light and power, and toilet facilities consisting of one lavatory and one water closet complete with connections to water and sewer mains. A mail slot in the door or a lockable mail box mounted on the surface of the door shall be provided. At completion of the project, the office shall remain the property of the Contractor and shall be removed from the site. Utilities shall be connected and disconnected in accordance with local codes and to the satisfaction of the Contracting Officer.

1.6.2 Trailer-Type Mobile Office

The Contractor may, at its option, furnish and maintain a trailer-type mobile office acceptable to the Contracting Officer and providing as a minimum the facilities specified above. The trailer shall be securely anchored to the ground at all four corners to guard against movement during high winds.

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 42 inches high, supported and tightly secured to steel posts located on maximum 10 foot 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.

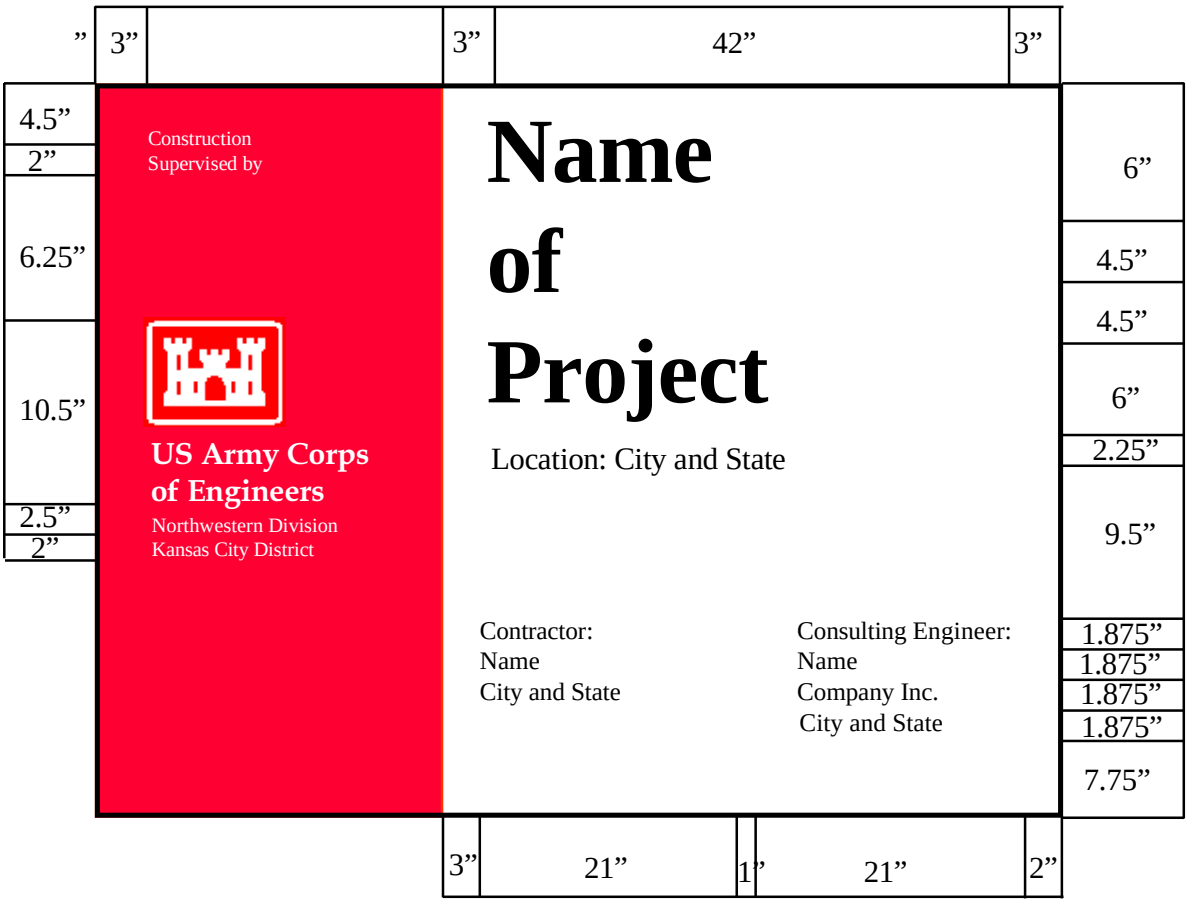
1.10 RESTORATION OF STORAGE AREA

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.

-- End of Section --

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 panel on the right is to be white with black legend. The 2'x 4' section of the sign on the left with with the full Corps signature (reverse version) is to be screen printed Communications Red on the White background.

This sign is to be placed with the Safety Performance Sign (See Fig. 2).



Legend Group 1: One to two-line description of Corps relationship to project
Color White
Typeface 1.25" Helvehca Regular
Maximum line lenth: 19"

Legend Group 2: Division\ District Name Placed below 10.5" Reverse Signature (6" Castle).
Color: White
Typeface: 1.25" Helvetica Regular

Legend Group 3: One- to three-line project title legend describes the work beging done under this contract.
Color: Black
Typeface: 3" Helvetica Bold
Maximum line length: 42"

Legend Group 4: One- to two-line identification of project or facility (civil works) or name of sponsoring department (military).
Color: Black
Typeface: 1.5" Helveticia Regular
Maximum line length: 42"

Cross-align the first line of Legend Group 4 with the first line of the Corps Signature (US Army Corps) as shown.

Legend Groups 5a-b: One- to five-line identification of prime contractors including: type (arcthitect, general contractor, etc.), corporate or firm name, city, state. Use of Legend Group 5 is optional.
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.
Letter- and word-spacing to follow Corps standards

Sign Type	Legend Size	Panel Size	Post Size	Specification Code	Mounting Height	Color Bkg/Lgd
CID-01	Various	4' x 6'	4" x 4"	HDO-3	48"	WH-RD/BK

CONSTRUCTION SIGN (CORPS OF ENGINEERS DESIGN)
(Use with Fig 2)

Fig. 1

SAFETY PERFORMANCE SIGN

Each contractor's safety record is to be posted on Corps managed or supervised construction projects and mounted with the construction project identification sign.

The graphic format, color, size and typefaces used on the sign are to be reproduced exactly as specified below. The title with First Aid logo in the top section of the sign and the performance record captions are standard for all signs of the type. Legend Groups 2 and 3 below identify the project and the contractor and are to be placed on the sign as shown.

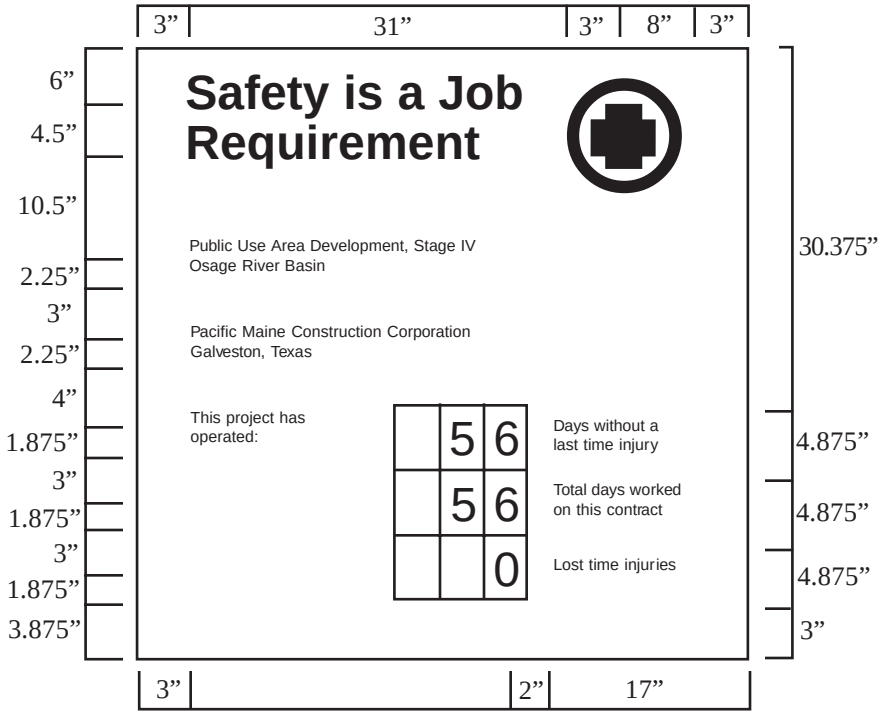
Safety record numbers are mounted on individual metal plates and are screw mounted to the background to allow for daily revisions to posted safety performance record.

Legend Group 1: Standard two-line title "Safety is a Job requirement" with (8 od.) Safety Green First Aid logo.
Color: to match PMS 347
Typeface: 3" Helvetica Bold
Color: Black

Legend Group 2: One to two-line project title legend describes the work being done under this contract and name of host project.
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Legend Group 3: One to two-line identification; name of prime contractor and city, state address.
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Legend Group 4: Standard safety record captions as shown.
Color: Black
Typeface: 12.5" Helvetica Regular



Sign Type	Legend Size	Panel Size	Post Size	Specification Code	Mounting Height	Color Bkg/Lgd
CID-02	Various	4' X 4'	4" X 4"	HDO-3	48"	WH/BK - GR

Replaceable numbers are to be mounted on white .060 aluminum plates and screw-mounted to background.
Color: Black
Typeface: 3" Helvetica Regular
Plate size: 2.5" X 5"

All typography is flush left and rag right. Upper and lower case with initial capitals only as shown. Letter - and word - spacing to follow Corps standards.

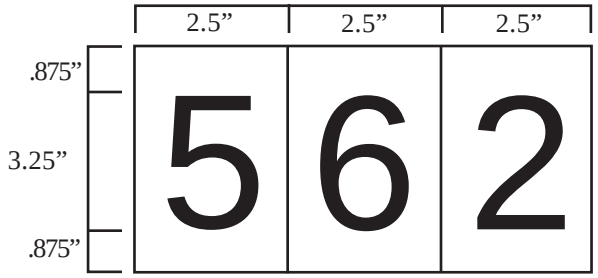


Fig. 2

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01720

AS-BUILT DRAWINGS

PART 1 GENERAL

1.1. SCOPE: This section covers as-built drawings technical requirements and provides information on preliminary and final as-built drawing submittals.

1.2 APPLICABLE PUBLICATIONS: Not Used.

1.3 SUBMITTALS: As-built drawings of preliminary and final work shall be as stated below:

1.3.1 Contracts having multiple items of work. Submit one copy of the preliminary as-built drawings which the Contractor has reproduced from the preliminary as-built drawing CADD files at the time of the final inspection on each interim item of work.

1.3.2 Contracts having a single item of work and the chronologically last item of work on contracts having multiple items of work. Submit approved as-built drawing CADD files and one set of red-lined prints at the time of the final inspection on the last/only item of work.

1.3.3 All contracts. Submit final as-built drawing CADD files and red-lined prints as stated in paragraph 1.6 below.

1.4 GENERAL: As part of the contract documents, the Contracting Officer will furnish the Contractor a complete set of contract drawings in Microstation™ PC CADD Program format (*.dgn files) on a compact disc. The Contractor shall develope, maintain, and submit as-built drawings using Microstation™ PC CADD Program format only. No other CADD program is acceptable. As-built drawings shall be a record of the construction as installed and completed by the Contractor. They shall include all the information shown on the contract set of drawings and a record of all deviations, modifications, or changes from those drawings, however minor, which were incorporated in the work, all additional work not appearing on the contract drawings, all changes which are made after the final inspection of the contract work and the location and size of all uncharted existing utilities encountered. In the event the Contractor accomplishes additional work which changes the as-built conditions of the facility after submission of the as-built drawings, the Contractor shall furnish revised and/or additional drawings as required to depict as-built conditions. The requirements for these additional drawings will be the same as for the as-built drawings included in the original submission. The fire protection/ detection as-built drawings will be a finalized version of the fire protection/detection shop drawings.

1.5 PRELIMINARY AS-BUILT DRAWINGS: The Contractor shall modify both CADD files and red-lined prints to show as-built conditions. These two sets, hereafter called preliminary as-built drawings, or singly, CADD files or red-lined prints, shall be kept current and available on the job site at all times, except as noted below. A member of the Contractor's Quality Control Organization shall be assigned responsibility for the maintenance and currency of the preliminary as-built drawings. This assignment and any reassignment of duties concerning the maintenance of the as-built drawings shall be promptly reported to the Contracting Officer for his approval. All changes from the contract plans which are made during the course of the work or additional information which might be uncovered in the course of construction, including uncharted

utilities, shall be accurately and neatly recorded as they occur by means of details and notes. All changes and/or required additions to the preliminary as-built drawings shall be clearly identified in a color contrasting to color of drawings and which is compatible with reproduction of the preliminary as-built CADD files. During periods when the CADD files are being copied and are therefore not available at the job site, the Contractor shall continue posting all required data to the red-lined prints. The Contractor shall minimize the time that the CADD files are away from the job site and he shall update them with all as-built data immediately upon their return. The CADD files and red-lined prints will be jointly inspected for accuracy and completeness by the Contracting Officer's Quality Control Organization prior to submission of each monthly pay estimate. (See paragraph: Withholding for Preliminary As-Builts.) The as-built drawings shall show the following information, but not be limited thereto.

1.5.1 Locating Utilities and Other Features: The location and description of any utility lines or other installation feature of any kind or description known to or found to exist within the construction area shall be recorded on as-built drawings. The location of exterior utilities includes actual measured horizontal distances from utilities to permanent facilities/features. These measurements shall be within an accuracy range of 6 inches and shall be shown at sufficient points to permit easy location of utilities for future maintenance purposes. Measurements shall be shown for all change of direction points and all surface or underground components such as valves, manholes, drop inlets, cleanouts, meter, etc. The general depth range of each underground utility line shall be shown (i.e., 3 feet to 4 feet depth). The description of the exterior utilities includes the actual quantity, size, and material of the utility lines.

1.5.1.1 The location and dimensions of any changes within the building or structure.

1.5.1.2 Correct grade or alignment of roads, structures, or utilities if any changes were made from contract plans.

1.5.1.3 Correct elevations if changes were made in site gradings.

1.5.1.4 Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

1.5.1.5 The topography and grades of all drainage installed or affected as a part of the project construction.

1.5.1.6 Where contract drawings or specifications allow options, only the option selected for construction shall be shown on the as-built drawings.

1.5.2 Review of Preliminary As-Built Drawings: As part of the prefinal inspection for each item of work, the preliminary as-built drawings will be reviewed. The Contractor must comply with this specification prior to scheduling the final inspection, and/or prior to substantial completion of the item of work.

1.5.3 Submittal of Preliminary As-Built Drawings: Prior to scheduling the final acceptance inspection of the last/only item of work, the preliminary as-built drawings shall be completed and submitted for review and approval. If upon review, the drawings are found to contain errors and/or omissions, they will be returned to the Contractor for corrections. Failure of the Contractor

to make timely delivery of the preliminary as-built drawings on any/all items of work will be cause for the Government to delay substantial completion, and to assess liquidated damages in accordance with the terms and conditions of the contract.

1.5.4 Withholding For Preliminary As-Built Drawings: Failure by the Contractor to maintain current and satisfactory preliminary as-built drawings in accordance with these requirements will result in withholding from progress payments an amount determined by the Contracting Officer as the value of the subject as-built drawings, and will indicate this unearned amount on monthly payment estimates until the Contractor has fulfilled the contract requirements.

1.6 FINAL AS-BUILT DRAWINGS: Upon approval of the preliminary as-built drawings, the Contractor will modify the original drawings as may be necessary to correctly show all the features of the project as it has been constructed by bringing the contract set into agreement with the approved preliminary as-built drawings, adding additional drawings as may be necessary. The original drawings are part of the permanent records of this project and the Contractor shall be responsible for the protection and safety thereof until returned to the Contracting Officer.

1.6.1 CADD: Only personnel proficient in Microstation™ PC CADD Program and the preparation of engineering/architectural drawings shall be employed to modify the original contract drawings or prepare additional new drawings. All additions and corrections to the contract drawings shall be neat, clean, and legible and shall match the adjacent existing linework and/or lettering being annotated in type, density, size and style. Drafting not meeting these requirements will be justification for the government not accepting the as-built drawings and will require the Contractor to resubmit the drawings until accepted.

1.6.1.1 When final revisions have been completed, delete all change clouds, revision triangles, and listings of amendments, modifications, and changes. Completed as-built drawings shall be "clean" drawings showing only a "finished" product with all changes incorporated. Each drawing shall be lettered or stamped with the date of completion and words "**RECORD DRAWING**" in letters at least 3/16 inch high placed below the title block between the border and the trim line. Each drawing shall be lettered or stamped with the date of completion and the words **"REVISED FOR AS-BUILT CONDITIONS"** on the first line in the revision block.

1.6.1.2 Title blocks to be used for any new as-built drawing shall duplicate that used on the original drawings.

1.6.2 Copies of the Final As-Built Drawings: Red-lined prints shall be full size prints of the original drawings 22 inch by 34 inch image on 24 inch by 36 inch sheet or 26 inch by 40 inch image on 28 inch by 42 inch sheet, as appropriate. All red-lined prints shall exhibit good readable print with clear, sharp, dark lines, and shall not be smeared, faded, double imaged, or have torn or ragged edges.

1.6.3 Submittal of Final As-Built Drawings: Submit final as-built drawings in Microstation™ PC CADD Program format on a compact disc and one set of full size original as-built drawings plotted on Mylar within 30 calendar days following final acceptance of construction. All CADD files and original as-built drawings plotted on Mylar will become the property of the Government upon final approval.

1.6.4 Withholding For Final As-Built Drawings: Failure to submit final as-built drawings as required herein will be cause for withholding final payment

due the Contractor. Approval and acceptance of final as-built drawings will be accomplished before final payment is made to the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

DIVISION 2 – SITE WORK

02050	Demolition
02080	Asbestos Containing Materials Removal and Disposal
02223	Excavation, Filling and Backfilling for Paving, Structures, and Utilities
02510	Asphaltic Concrete Paving
02520	Portland Cement Concrete Paving, Sidewalks, Curbs, and Gutters
02930	Seeding and Fertilizing

DIVISION 2 - SITE WORK

SECTION 02050

DEMOLITION

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for demolition and disposal required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standard:

Z133.1 Safety Requirements for Tree Care Operations-Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush.

1.2.2 Defense Reutilization and Marketing Service (DRMS) Turn-In Instructions:

DRMS Turn-In Instructions. These Instructions are available at the DRMS Website (www.drms.com/turn-in/).

1.2.3 National Institute of Building Sciences (NIBS) Publication:

Lead-Based Paint, Operations and Maintenance Work Practices Manual for Homes and Buildings.

1.2.4 U.S. Army Technical Manual (TM):

5-630 Natural Resources Land Management.

1.2.6 U.S. Department of Housing and Urban Development (HUD Guidelines) Publication:

Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing.

1.3 SUBMITTALS:

1.3.1 Receipts: Obtain receipts for all salvable items turned in to Government Agencies and submit copies of the receipts. DD Forms 1348-1 serves as receipt for items turned in to DRMO.

1.3.2 DD Form 1348-1: Prepare DD Form 1348-1 in accordance with DRMS Turn-In Instructions for all items turned in to DRMO. DD Forms 1348-1 may be obtained from DRMO. Submit copies of DD Form 1348-1.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 DEMOLITION AND DISPOSAL: Demolish or remove from the work site all items designated to be demolished or removed as part of the replacement process, and any other items necessary to accomplish the required work. The plans and specifications may not designate all demolition and removal items existing at the work site. Therefore, prior to beginning demolition or removal work, verify with the COR all items to be demolished or removed and all items to remain. The Contractor is responsible for loading, hauling, and unloading salvage items and debris. The Contractor is also responsible for preparing salvage items for turn in at the DRMO.

3.1.1 Removal: Carefully remove salvage items to prevent unnecessary damage to items to be salvaged or portions of components and structures to remain. Salvable items shall be removed and protected to prevent unnecessary damage. Items, embedded in concrete or masonry, or which are otherwise nonremovable, shall be neatly cut off at or beneath the surrounding surface. Open piping or conduit shall be capped or plugged, and the surrounding surface repaired as specified. Asphalt and concrete being removed shall be removed along saw cut lines.

3.1.2 Disposition of Salvable and Recyclable Items: Construction materials, which have salvage or recycling value, or which can be dismantled or removed without damage, shall be turned in at the PW Property Book Office, FN 317; PW Operations Center, FNs 368-372; the DES Recycle Center, FN 1980; or the DRMO Yard, FN 1950; as indicated below or as directed by the COR. Unless otherwise indicated, salvable items include: sheet metal items including flashings, fascias, gutters, and downspouts; metal doors, door frames, builders' hardware, and windows; metal toilet and bath accessories; metal toilet partitions; appliances; metal pipe, pipe fittings, and valves all with insulation removed; metal plumbing fixtures and serviceable vitreous china plumbing fixtures; fire protection equipment and appurtenances; HVAC equipment and appurtenances; and electrical components, equipment, and fixtures.

3.1.2.1 Salvable Items:

3.1.2.1.1 Appliances: Turn in salvable (functioning) appliances at the PW Property Book Office, FN 317, or DRMO in accordance with DRMS Turn-In Instructions, as directed by the COR. Turn in salvable (nonfunctioning) appliances at DRMO in accordance with DRMS Turn-In Instructions. When DRMO will not accept salvable (nonfunctioning) appliances dispose of the appliances off the installation at a state-approved disposal site. The Riley County Transfer Station will accept appliances with the refrigerant removed and the proper certification for $8.50 each and with the refrigerant still in the appliance for $18.50 each (1 May 2001 charges).

3.1.2.1.2 Water Heaters and HVAC Equipment: Turn in salvable (nonfunctioning) water heaters and HVAC equipment at DRMO in accordance with DRMS Turn-In Instructions. When DRMO will not accept salvable (nonfunctioning) water heaters and HVAC equipment dispose of the water heaters and HVAC equipment off the installation at a state-approved disposal site. The Riley County Transfer Station will accept water heaters and HVAC equipment with the refrigerant removed and the proper certification for $8.50 each and with the refrigerant still in the HVAC equipment for $18.50 each (1 May 2001 charges).

3.1.2.1.3 Scrape Metal and Other Salvable Items: Turn in scrap metal and other salvable items indicated in paragraph 3.1.2 above at DRMO in accordance with DRMS Turn-In Instructions or the DES Recycle Center, as directed by the COR.

3.1.2.2 Recyclable Materials: Turn in recyclable material at the DES Recycle Center.

3.1.3 Disposition of Nonsalvable and Nonrecyclable Items: Construction materials and debris, which will have no salvage or recycling value because of the type of material or the procedures required for dismantling or demolition, shall be disposed of at the Riley County Transfer Station or other off-post landfill; the DES Environmental Waste Management Center (EWMC) or DES Compost Area, vicinity of FN 1945; or the Fort Riley Demolition and Construction Debris Landfill (FRDCDL) located in the Campbell Hill Quarry 2 miles north of Camp Funston; as indicated below or as directed by the COR. Use of the DES EWMC and Compost Area and FRDCDL shall be coordinated with the COR. Unless otherwise indicated, nonsalvable items include: refuse; vegetative waste; tires; miscellaneous concrete and masonry items; wood and wood products; nonmetallic roofing materials; wood doors, door frames, windows, trim, and glazing; gypsum wallboard, plaster, and acoustical ceiling board; floor and wall coverings; and nonmetallic plumbing, mechanical, and electrical components.

3.1.3.1. Refuse: Place only ordinary refuse in dumpsters. No vegetative waste, construction and demolition waste, tires, recyclable materials, salvable items, or hazardous materials or waste will be placed in dumpsters. Large amounts of refuse shall be delivered to an off-post landfill and fees paid by the Contractor.

3.1.3.2 Vegetative Waste: Dispose of vegetative waste at the DES Compost Area.

3.1.3.3 Construction and Demolition Waste: Dispose of debris contaminated soil, rock, concrete, masonry, wood, etc. at the FRDCDL.

3.1.4 Hazardous Materials and Hazardous Wastes: Dispose of ACM and building components contaminated with LBP at the FRDCDL. Turn in all other hazardous materials and hazardous wastes at the DES EWMC in accordance with DES EWMC Turn In Instructions.

3.1.5 DRMO Turn In Procedures: When items are being turned in to DRMO, prepare the items for turn in in accordance with DRMS Turn-In Instructions. DRMO procedures include the following:

3.1.5.1 Location and Hours of Operation: FN 1950, Camp Funston, Hours 7:30 a.m. thru 3:00 p.m., Monday thru Thursday except Federal Holidays. Friday by appointment only.

3.1.5.2 Alternate Turn In Schedule: When large quantities of items are being turned in, generating activities shall contact DRMO Receiving Coordinators, as appropriate, to advise the number of truckloads scheduled and turn in date. DRMO Receiving Coordinators can be reached at 239-6202.

3.1.5.3 Documentation: All items must be accompanied by properly prepared turn in documents (DD Forms 1348-1). The forms shall be prepared with a minimum of one original and 4 copies. The first three copies will be used for processing the items into the accounting system. The fourth copy will be proof of delivery copy to acknowledge receipt and be returned to the Contractor. The official receipt copy will be returned upon completion of processing the items into the accounting system. The Contractor is advised to obtain a copy of DRMS Turn-In Instructions for instructions on completing the Form.

3.1.5.4 Removal of Concrete: Remove concrete from items which were imbedded in concrete such as pipe, and building structural members.

3.1.5.5 Segregation of Metals: Segregate scrap metal by type and thickness.

3.1.5.6 Removal of Insulation: Remove insulation from metal pipe, pipe fittings, valves, and ductwork.

3.1.5.7 Removal of Refrigerants: Remove and properly dispose of all refrigerants prior to turn in of appliances and HVAC equipment. May also require removal and disposal of compressor oil.

3.1.5.8 Removal of Ballasts: Remove and properly dispose of ballasts prior to turn in of all types of light fixtures.

3.1.5.9 Palletizing and Banding: Palletize and band salvable items on 4 by 4 foot pallets as required. Pallets shall be supplied by the Contractor.

3.1.5.10 Unloading Material at DRMO: Unload salvable items at DRMO.

3.2 CUTTING AND PATCHING:

3.2.1 Cutting: Accomplish cutting using power tools and equipment which are best suited for the task being accomplished and least likely to damage adjoining or adjacent surfaces.

3.2.2 Patching: Patch adjoining or adjacent surfaces using materials which match the existing materials. Joints and seams shall be durable and as invisible as possible. Restore finishes of patched areas to match the existing finishes.

3.3 ASBESTOS CONTAINING MATERIALS (ACM): The Contractor shall remove and dispose of asbestos containing materials in accordance with SECTION 02080, ASBESTOS CONTAINING MATERIALS REMOVAL AND DISPOSAL. Building components, piping, fittings, valves, and other HVAC components being removed as part of this project which are insulated with insulation found to contain asbestos shall have the insulation removed from the items prior to disposal.

The Contractor shall immediately notify the COR should he encounter insulation or other building materials which he suspects may contain asbestos and are not indicated for removal. The COR will coordinate with DES for testing of the suspect material. Based on the test results, the Contractor may then be directed to remove and dispose of ACM in accordance with SECTION 02080, ASBESTOS CONTAINING MATERIALS REMOVAL AND DISPOSAL.

3.4 LEAD-BASED PAINT (LBP): The Contractor shall immediately notify the COR should he encounter building surfaces which he suspects may be covered with lead-based paint. The COR will coordinate with DES for testing of the suspect surface.

3.4.1 Surface coatings on sixty-seven representative doors, walls, trim components, railings, etc. at Building #446 have been tested for the presence of lead-based paint utilizing nondestructive XRF test methods. None of the surface coatings tested at or above the threshold value (1.0 mg/cm^2) for lead-based paint. Contractors should be advised, however, that regulations contained in 29 CFR 1926.62 must be followed when any surface coating with measurable amounts of lead is disturbed (sanding, abrading, grinding, burning, etc.) that may result in occupational exposure to lead dust or fume at or above OSHA’s action level. If any lead-related questions arise, they should be addressed to the contracting officer prior to the disturbance of the material.

3.5 VEGETATION TRIMMING AND PRUNING: Professionally trim and prune trees, vines, and other vegetation as necessary to accomplish the required work in accordance with TM 5-630 and ANSI Z133.1. Vegetation trimming and pruning in-

cludes removal of vegetation from building surfaces down to the ground and pruning trees so that branches are a minimum of three feet away from building surfaces. Cut dead tree branches back to where they join with living branches. Repair damage caused by the Contractor during vegetation trimming, pruning and removal operations at no additional cost to the Government.

3.6 CLEANUP: Remove debris and perform general cleanup of the work site at the end of each workday and upon completion of the required work. Ensure that waste and debris at the work site does not blow off the site. Be responsible for immediate cleanup of spillage wherever it might occur.

DIVISION 2 - SITE WORK

SECTION 02080

ASBESTOS CONTAINING MATERIALS REMOVAL AND DISPOSAL

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for removal and disposal of asbestos containing materials (ACM) or presumed asbestos containing materials (PACM) required in this contract.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Conference of Governmental Industrial Hygienists (ACGIH) Publication:

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (TLVs and BEIs).

1.2.2 American National Standards Institute (ANSI) Standards:

Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems.

Z88.2 Practices for Respiratory Protection.

1.2.3 American Society for Testing and Materials (ASTM) Publication:

D4397 Polyethylene Sheeting for Construction, Industrial and Agricultural Applications.

1.2.4 National Institute for Occupational Safety and Health (NIOSH) Publications:

84-100 Manual of Analytical Methods.

85-115 Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.

1.2.5 State of Kansas Publications (KAR):

28-31 Hazardous Waste Management.

28-50 Asbestos Control Regulation.

1.2.6 Underwriters Laboratories (UL) Publication:

586 Test Performance of High Efficiency Particulate Air Filter Units.

1.2.7 U.S. Army Corps of Engineers Manual (EM):

385-1-1 General Safety and Health Requirements.

1.2.8 U.S. Department of Labor Occupational Safety and Health Administration (OSHA) Regulations:

29 CFR 1910.20	Access to Employee Exposure and Medical Records.
29 CFR 1910.95	Occupational Noise Exposure.
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response.
29 CFR 1910.133	Eye and Face Protection.
29 CFR 1910.134	Respiratory Protection.
29 CFR 1910.1001	Asbestos, Tremolite, Anthophylite, and Actinolite.
29 CFR 1926.59	Hazard Communication.
29 CFR 1926.1101	Asbestos.

1.2.9 U.S. Department of Transportation (DOT) Regulations:

49 CFR 171	Hazardous Substances.
49 CFR 172 Subparts B & C	Hazardous Materials Tables and Hazardous Materials Communications Regulations.
49 CFR 173 Subpart M	Shippers - General Requirements for Shipments and Packaging.

1.2.10 U.S. Environmental Protection Agency (EPA) Regulations:

40 CFR 61 Subpart A	National Emission Standards for Hazardous Pollutants-General Provisions.
40 CFR 61 Subpart M	National Emission Standards for Hazardous Air Pollutants-National Emission Standard for Asbestos.

1.3 SUBMITTALS:

1.3.1 Notifications and Permits:

1.3.1.1 The Contractor shall prepare and submit written notification to the EPA Region VII Office at:

EPA Region VII Office
ATTN: Regional Asbestos Coordinator
726 Minnesota Avenue
Kansas City, Kansas 66101
(913) 551-7020

1.3.1.2 In accordance with 40 CFR 61 Subpart M, prepare and submit written notification and pay all fees required to the State of Kansas Department of Health and Environment:

Kansas Department of Health and Environment
ATTN: John Irwin or Russ Brichacek
Forbes Field
Topeka, Kansas 66620
(913) 296-1542/1544

1.3.1.3 Obtain the required solid waste identification permit from:

Chief, Solid Waste Management Section
Bureau of Environmental Sanitation
Kansas Department of Health and Environment
Attn: Miles Stotts
Forbes Field
Topeka, Kansas 66620
(913) 296-1601

1.3.1.4. Submit copies of the notifications and permit not less than ten working days prior to the start of the work.

1.3.2 Removal and Disposal Plan: Submit an ACM Removal and Disposal Plan. Retain and utilize the services of an American Board of Industrial Hygiene, Certified Industrial Hygienist (CIH) to develop, implement, and enforce a written ACM Removal and Disposal Plan. Include CIH's signature and certification number in the plan. Plan may be general in nature with annexes or addenda which tailor the plan to special locations or locations within the building(s). As a minimum, plan shall discuss and describe or provide:

1.3.2.1 Employee training.

1.3.2.2 Personal protective equipment and clothing.

1.3.2.3 Employee decontamination.

1.3.2.4 Air monitoring and sampling.

1.3.2.5 Heat stress monitoring and preventive measures.

1.3.2.6 Pressure differential monitoring and recording.

1.3.2.7 Medical examinations and fitness reports.

1.3.2.8 Sequencing of ACM abatement related work and interfacing with other trades involved in construction.

1.3.2.9 Pre-removal preparation.

1.3.2.10 ACM abatement and post-removal cleanup verification procedures.

1.3.2.11 Waste storage and disposal.

1.3.2.12 Locations of isolation enclosures and negative air pressure systems.

1.3.2.13 Location of decontamination and temporary waste storage facilities.

1.3.2.14 Location of the boundaries of contaminated work areas.

1.3.3 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.4 List of Equipment: Submit a certified list or manufacturer's descriptive literature for all asbestos removal, cleaning, personal protective, and air monitoring equipment proposed for use in work under this section. The list of equipment shall include certification that the Contractor's vacuums and other equipment required to contain filtering meet the requirements of ANSI Z9.2 and UL 586.

1.3.5 Test Results: Submit test results from air monitoring and suspected ACM bulk samples.

1.3.5.1 Air Monitoring Results: Written air monitoring results shall be reported to the Contracting Officer within 16 hours after the completion of a sampling period with certified written results to be submitted within 5 working days. Test results shall indicate each sample's pump serial number, time weighted average (TWA) or excursion limit (EL) fiber count, pump start time, pump stop time, date, pump flow rate, and exact location of where the sample was taken, as well as the items required for documentation as discussed in paragraph 3.5, AIR MONITORING REQUIREMENTS. Test results for personal air samples shall also include the employees' names and social security account numbers. Air concentrations for area sampling shall not be calculated by time weighted averaging. Time weighted averaging is permissible only for personnel sampling. Prepare and submit within 15 working days after the completion of all airborne asbestos monitoring in the building, ENG Form 4921-R "Summarization of Airborne Asbestos Sampling Results". In addition, maintain results of air monitoring tests for 30 years in accordance with 29 CFR 1926.1101. Test results shall include the names of the persons performing the air monitoring and the analyst who conducted the sample analysis and shall bear the following statement:

> I certify that the above samples were taken and the TWA fiber counts performed in strict compliance with applicable standards and regulations.
>
> _____
> (Signature of ABIH Certified Hygienist)

1.3.5.2 Suspected Insulation Sample Test Results: Submit suspected ACM bulk test results within 48 hours after taking the sample. Test results shall indicate the type of insulation sampled (piping, equipment, boiler, ducts or spray applied surface insulation), friability, pipe size (if pipe insulation), or estimated area of the material, thickness, whether or not asbestos was detected, percentage and type of asbestos, and exact location of where the sample was taken. Floor plans referencing each sample's location, type, size, and thickness shall be attached to each copy of test results.

1.3.5.3 Negative Pressure Recordings: Negative pressure in ACM enclosures shall be continuously monitored and recorded throughout the duration of the ACM abatement project. Monitoring records shall be signed by the CIH/IHT and submitted to the Contracting Officers Representative (COR) at the beginning of the next working day following the day in which the monitoring was conducted.

1.3.6 Proof of Participation and Accreditation: Submit proof that the independent industrial hygiene or environmental health testing laboratory used for air sample analysis is successfully participating in the "Proficiency Analytical Testing (PAT) Program for Laboratory Quality Control for Asbestos" as established by the National Institute for Occupational Safety and Health (NIOSH); and is accredited under the Laboratory Accreditation Program (for laboratories) or if individual counters are to be utilized on-site, the counters shall be listed with the Asbestos Registry of the American Industrial Hygiene Association for Asbestos prior to the start of the ACM removal project. If individual counters are utilized, the Contractor shall supply his own work area.

1.3.6.1 Submit proof that the testing lab performing bulk sample analysis of suspected ACM is successfully participating in the U.S. Environmental Protection Agency's (EPA) Bulk Asbestos Sample Quality Assurance Program, or the National Bureau of Standards (NBS) National Voluntary Laboratory Accreditation Program (NVLAP) prior to the start of the asbestos removal project.

1.3.6.2 Submit the name, experience qualifications, and proof of certification of the Industrial Hygienist with the submission of the ACM Removal and Disposal Plan.

1.3.6.3 Submit the name, qualifications, and work experience of the Industrial Hygiene Technicians.

1.3.7 Proof of License and/or Registration: Submit proof of license and/or registration in the state of Kansas to remove ACM. The Contractor's competent person(s) must possess Class II Asbestos Licenses. All asbestos workers must possess Kansas Class I Asbestos Licenses.

1.3.8 Proof of Employee Certification: Submit proof that employees have been certified in the state of Kansas to remove ACM.

1.3.9 Proof of Disposal: Submit fully completed Waste Shipment Records (WSR), or other documentation in compliance with EPA and State requirements, attesting to the fact that ACM have been disposed of in accordance with 40 CFR 61 Subpart M and KAR 28-50, at the Installation Construction Debris Landfill (CDL). Documentation shall include, but not be limited to, the following items:

1.3.9.1 Name, address, and telephone number of the waste generator.

1.3.9.2 Name and address of the local, State, or EPA Regional Office responsible.

1.3.9.3 Approximate quantity (cubic meters or cubic yards) of ACM disposed of.

1.3.9.4 Name and telephone number of the disposal site operator.

1.3.9.5 Name and physical site location of the disposal site.

1.3.9.6 Date transported; the name, address, and telephone number of the transporter(s).

1.3.9.7 Certification that the contents of the consignment are fully and accurately described by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable local, State, and Federal regulations.

1.4 TERMINOLOGY:

1.4.1 Abatement: Procedures to eliminate fiber release from ACM.

1.4.2 Air Monitoring: The process of measuring the asbestos fiber content of a specific volume of air in a stated period of time. Personal air sampling results shall be calculated to reflect the employees 8-hour time weighted average (TWA) or 30 minute excursion limit (EL) exposure. Area sampling results are reported direct without calculating the TWA.

1.4.3 Airlock: A system for permitting ingress and egress without permitting air movement between a contaminated area and an uncontaminated area, typically consisting of two curtained doorways at least 2 to 3 feet apart.

1.4.4 Amended Water: Water to which a surfactant has been added.

1.4.5 Asbestos: A general term used to describe several fibrous mineral silicates. Although there are many asbestos minerals, only six are of commercial importance. They are: Actinolite, amosite, anthorphyllite, chrysotile, crocidolite, and tremolite. For the purposes of this Contract the term "asbestos" is used interchangeably with "asbestos-containing sprayed material", "dust-containing asbestos fibers", "pipe insulation containing asbestos", and "friable and non-friable insulating material containing asbestos".

1.4.6 ACM Control Area: An area where ACM removal operations are performed and which is sealed and/or isolated by physical barriers to prevent the spread of asbestos contamination.

1.4.7 ACM Removal Encapsulant: A chemical solution used in place of amended water during removal to penetrate and encapsulate ACM.

1.4.8 ACM Encapsulant Sealer: A liquid material which, when applied, controls the possible release of asbestos fibers either by creating a membrane over the surface or by penetrating the material and binding its components together.

1.4.9 Class I Asbestos Work: Activities involving the removal of asbestos containing material (ACM) or presumed asbestos containing material (PACM) that is surfacing material or thermal system insulation (TSI).

1.4.10 Class II Asbestos Work: Activities involving the removal of ACM or PACM that is not surfacing material or TSI.

1.4.11 Class III Asbestos Work: Maintenance and custodial activities where ACM or PACM may be disturbed.

1.4.12 Class IV Asbestos Work: Maintenance and custodial activities where ACM or PACM may be contacted.

1.4.13 Clean Room: An uncontaminated area or room which is part of the worker decontamination enclosure system, with provisions for storage of workers' street clothes and protective equipment.

1.4.14 Competent Person: Definition and responsibilities as delineated in 29 CFR 1926.1101 and as outlined herein. The competent person shall be the project's supervisor or foreman and shall be on-site continuously throughout all ACM abatement operations.

1.4.15 Curtained Doorway: A device to allow ingress or egress from one room to another while permitting minimal air movement between the rooms, typically constructed by placing three overlapping sheets of 6-mil polyethylene sheet over an existing or temporarily framed doorway, securing each along the top of the doorway, and securing the vertical edges of the outer sheets along one vertical side of the doorway, and securing the vertical edge of the middle sheet along the opposite vertical side of the doorway. The sheets shall be weighted so that they close quickly after being released.

1.4.16 Equipment Room: The first room to be entered from the ACM control area to begin the decontamination process in the worker decontamination enclosure system, with provisions for collection of used disposable protective clothing, and the removal, cleaning and storage of reusable protective clothing.

1.4.17 Friable ACM: Any material which contains more than 1 percent asbestos by weight that hand pressure can crumble, pulverize, or reduce to powder when dry.

1.4.18 Glove Bags: A manufactured device consisting of a glove bag (typically constructed of 6-mil or thicker transparent sheet polyethylene), two inward projecting long sleeve gloves, one inward projecting water wand sleeve, an internal tool pouch, and an attached, labeled receptacle for collection of removed asbestos waste. The glove-bag is constructed and installed in such a manner that it surrounds the object or area to be decontaminated and contains all asbestos fibers released during the removal process.

1.4.19 HEPA Filters: High Efficiency Particulate Absolute (HEPA) filters capable of trapping and retaining 99.97 percent of asbestos fibers greater than 0.30 microns in length.

1.4.20 HEPA Vacuum Equipment: High Efficiency Particulate Absolute (HEPA) filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining asbestos fibers.

1.4.21 Loading Area: A series of connected rooms with curtained doorways between any two adjacent rooms to be used for decontamination of bags of waste materials and equipment to be removed from the asbestos control area. This area shall be separated from the ACM control area by an air lock. After this area is constructed, all materials going into or leaving the ACM control area shall be through this loading area. No person shall enter or exit the ACM control area from outside by passing though the loading area. The loading area shall be considered contaminated to the same degree as the ACM control area and shall be separated by a barrier from other areas of the building.

1.4.22 Negative Air Pressure Equipment: A portable local exhaust system equipped with HEPA filtration and capable of maintaining a constant, low velocity air flow through the worker decontamination enclosure system and loading areas into contaminated work area from adjacent uncontaminated areas, and exhausting that air through a HEPA filter to the outside of the building through properly sealed ducts.

1.4.23 Removal: The act of removing and transporting asbestos-containing or contaminated materials from the structure to a suitable disposal site.

1.4.24 Shower Area: An area between the clean room and the equipment room in the worker decontamination enclosure system, with hot and cold running water and waste piping suitably arranged for complete showering of workers during decontamination, and collection of contaminated washwaters.

1.4.25 Surfactant: A chemical wetting agent, added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.

1.4.26 Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops or other cleaning tools which have been dampened with amended water or asbestos removal encapsulant, and then disposing of the cleaning tools as asbestos contaminated waste.

1.4.27 Ventilation Curtain: A ventilation curtain that is intended to allow unrestricted air flow movement into a contaminated area when it is being ventilated with an exhaust fan. This curtain shall consist of a single flap weighted at bottom, that opens into the contaminated area and is securely fastened across the top of the entry way frame work in a manner that will allow it to overlap both sides of the entry way by a distance of not less than 12 inches and the floor by a distance of not less than one inch.

1.4.28 Worker Decontamination Enclosure Systems: A decontamination enclosure system for workers, typically consisting of a clean room, a shower area, and a equipment room. The clean room and equipment room shall be separated from the shower area by airlocks. The enclosure system shall be separated from the asbestos control area by an airlock. The system may be constructed and later dismantled as required, or be a self-contained mobile type.

1.5 AIR MONITORING ANALYSIS: All air monitoring analysis shall be performed by an independent industrial hygiene or environmental health testing laboratory approved by the Certified Industrial Hygienist (CIH). The laboratory used for air sample analysis shall be successfully participating in the "Proficiency Analytical Testing (PAT) Program for Laboratory Quality Control for Asbestos" as established by the National Institute for Occupational Safety and Health (NIOSH); and is accredited under the Laboratory Accreditation Program (for laboratories) or if individual counters are to utilized on-site, the counters shall be listed with the Asbestos Registry of the American Industrial Hygiene Association for asbestos.

1.6 BULK SAMPLE ANALYSIS: Bulk samples if necessary shall be taken as directed by the Contracting Officer to verify the presence of asbestos, not to exceed four samples per building. The laboratory performing bulk sample analysis of suspected ACM shall be successfully participating in the U.S. Environmental Protection Agency's (EPA) Bulk Asbestos Quality Assurance Program (Research Triangle Institute, Research Triangle Park, NC), or the National Bureau of Standards (NBS) National Voluntary Laboratory Accreditation Program (NVLAP).

1.7 SAFETY AND HEALTH PERSONNEL QUALIFICATIONS:

1.7.1 Certified Industrial Hygienist (CIH): An independent CIH, contracted by the Contractor responsible to the Contractor with overall responsibility for the preparation, implementation, and enforcement of the ACM Removal and Disposal Plan, including the air monitoring program. This Certified Industrial Hygienist (American Board of Industrial Hygiene certified in the comprehensive Practice) shall have a minimum of 2 years specialized experience in the asbestos abatement industry. The CIH shall also have demonstrable expertise in air monitoring techniques and in the establishment of respirator protection programs. The CIH shall have a working knowledge of applicable State and Federal asbestos and Occupational Safety and Health regulations and formal educational in occupational safety and health. The CIH is not required to be present at the work site on a full-time basis. The CIH may delegate the ongoing implementation and enforcement of the ACM Removal and Disposal Plan, including the air monitoring program and final visual inspections of removal areas, to Industrial Hygiene Technicians defined below. The CIH shall conduct regular on site supervision and continued evaluation of effectiveness of the plan and the Industrial Hygiene Technicians implementation of such. Supervision shall include at least weekly inspections of the work site during asbestos removal and disposal operations. Prior to all gross removal, the CIH shall inspect each asbestos control area to ensure the enclosure is properly and completely sealed, that safety precautions are followed, that the HEPA exhaust units provide sufficient ventilation (verified by pressure differential readings, volume calculations, and smoke testing), and to ensure the required respiratory and personal protective equipment is available for the project. For glove bag removal, the CIH shall make at least one preliminary inspection of the removal site.

1.7.2 Industrial Hygiene Technician: The Industrial Hygiene Technician shall be an independent IHT assigned to the site on a full-time basis for the duration of the project with functional responsibility for the implementation and enforcement of the ACM Removal and Disposal Plan, including the air monitoring program and final visual inspections. The Industrial Hygiene Technician shall

have a minimum of 1 year working experience in the ACM abatement industry and shall have a sound working knowledge of applicable State and Federal occupational safety and health regulations and formal training in safety and health. The Industrial Hygiene Technician shall also have demonstrable experience in asbestos air monitoring techniques and respiratory protection program implementation. The IHT shall be accepted by and under the supervision of the CIH to implement and enforce the ACM Removal and Disposal Plan.

1.8 WORKER SAFETY AND PROTECTION:

1.8.1 Worker Training: The Contractor shall ensure that all of his employees who perform ACM removal and disposal have received training required by 29 CFR 1926.1101 and KAR 28-50 and that training records are on file in his office and available for review and/or submittal, and are maintained for 1 year beyond the last date of employment. Specific training requirements for the four Classes of asbestos work include: Class IV work requires 2 hours of Asbestos General Awareness Training; Class III work requires 16 hours of Asbestos Operations and Maintenance Training; Class I and II work requires 32 hours of Asbestos Worker Training and must be supervised by a Competent Person who has received 40 hours of Asbestos Contractor/Supervisor Training.

1.8.2 Worker Medical Examinations: The Contractor shall provide medical examinations for all employees engaged in ACM removal and disposal operations in accordance with 29 CFR 1910.134, 29 CFR 1926.1101, KAR 28-50, ANSI Z88.2, and EM 385-1-1. The Contractor shall ensure that all employee examination results are on file in his office and available for review, and are maintained in accordance with 29 CFR 1926.1101.

1.8.3 Worker Protection and Decontamination: The Contractor shall take all safety measures and precautions required to protect his employees and building occupants in accordance with 29 CFR 1926.1101, 40 CFR 61 Subpart M, and KAR 28-50. The Contractor shall provide his employees a worker decontamination enclosure system in accordance with 29 CFR 1926.1101 and KAR 28-50.

1.8.4 Posting Requirements: The Contractor shall post copies of 29 CFR 1926.1101, 40 CFR 61 Subparts A and M, and KAR 28-50 in the clean room of the worker decontamination enclosure system.

1.8.5 Heat/Cold Stress Prevention Program: The Contractor’s CIH shall develop and implement a Heat/Cold Stress Prevention Program, detailed in the ACM Removal and Disposal Plan, to protect workers from the effects of heat/cold and humidity levels expected during the removal project. As a minimum, the program shall describe training, and physiological (body temperature and pulse rate) and environmental monitoring to be conducted. The Heat/Cold Stress Prevention Program shall also establish work/rest periods associated with the physiological and environmental monitoring as outlined in NIOSH 85-115, ACGIH TLVs/BEIs, or other Contracting Officer approved methods.

1.8.6 Illumination: The Contractor shall ensure that all occupied spaces, including work, rest/break, and passageways, are illuminated to a minimum of 10 foot candles. Supplementary lighting shall be provided by the Contractor, as needed.

1.8.7 First Aid and Emergency Response Requirements: The Contractor shall provide for appropriate emergency first aid equipment, including an industrial-type first aid kit per paragraph 04.B, EM 385-1-1, and a 20-pound ABC-rated fire extinguisher.

1.9 BUILDING PROTECTION: The Contractor shall protect building furnishings, equipment, and other surfaces from the effects of the work in accordance with 40 CFR 61 Subpart M.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ACM HANDLING MATERIALS AND EQUIPMENT: Materials and equipment used to remove, handle, and dispose of ACM shall conform to 29 CFR 1926.1101, 40 CFR 61 Subpart M, KAR 28-31, and KAR 28-50.

2.2.1 Amended Water: Amended water shall contain a non-ionic wetting agent or surfactant. The recommended chemical composition of the surfactant is 50 percent polyoxyethylene ether and 50 percent polyoxyethylene ester, mixed in a proportion of one fluid ounce to 5 gallons of water, or as specified by the manufacturer. Where work temperatures may cause freezing of the amended water solution, the addition of ethylene glycol sufficient to prevent freezing is permitted.

2.2.2 ACM Removal Encapsulant: A chemical solution may be used in place of amended water during ACM removal to penetrate and encapsulate the ACM. The removal encapsulant shall be approved by the Contracting Officer.

2.2.3 ACM Encapsulant Sealer: ACM sealer shall be a commercial product which is tinted red and spray-applied by the airless method.

2.2.4 Emergency Power Equipment: Stand alone emergency power equipment shall be continuously at the site in case of power failure until final clearance air monitoring has been successfully completed. This equipment shall have 150 percent capacity of all equipment at the work site.

2.2.5 Polyethylene Sheeting: Conform to ASTM D4397 not less than 0.004 inch (4-mil) and 0.006 inch (6-mil) thick as required for the application.

2.2.6 Power Equipment: All power equipment shall conform to 29 CFR 1910.95 and 29 CFR 1926.1101. Employees and building occupants shall not be exposed to equipment noise levels higher than 84 dBA without being provided approved ear protection.

2.2.7 Vacuum and Exhaust Equipment: All vacuum and exhaust equipment shall have high efficiency particulate absolute (HEPA) filters which conform to ANSI Z9.2. HEPA filters shall be capable of effectively capturing 99.97 percent of asbestos fibers greater than 0.30 microns in size. No by-pass devices are permitted. Provisions shall be made to empty the debris collection hoppers without causing visible emissions of particulates.

2.2.8 Spraying Equipment: Spraying equipment used to apply the amended water or removal encapsulant shall be of a low pressure type to prevent disturbance of the ACM prior to physical, controlled removal. ACM encapsulant sealer shall be spray-applied by the airless method.

2.3 AIR MONITORING EQUIPMENT: Air monitoring equipment shall be as recommended by the American Industrial Hygiene Association. Samples of airborne fiber concentrations shall be collected with pumps fitted with 25 millimeter, three piece cassette with 50 millimeter electrically-conductive extension cowl and cellulose ester filter, 0.8 to 1.2 micrometer pore size, and backup pad.

2.4 WORKER PROTECTIVE CLOTHING AND EQUIPMENT: Worker protective clothing and equipment shall conform to 29 CFR 1910.133, 29 CFR 1910.134, 29 CFR 1926.1101, and EM 385-1-1.

2.4.1 Air-Purifying Respirators: All personnel engaged in ACM removal work shall wear an air-purifying respirator.

2.4.1.1 Types of Respirators: The Contractor shall provide workers with and require the use of respirators approved by the Mine Safety Health Administration (MSHA)/NIOSH for ACM in accordance with 29 CFR 1926.1101. The Minimum respiratory protection allowable shall be provided by an approved half mask air-purifying respirator with HEPA cartridges. Disposable single-use respirators are not acceptable. Upgrading of respiratory protection levels shall be the responsibility of the Contractor's CIH. Upgrading shall be based upon continued air monitoring and evaluations of work operations and practices. Supplied air and related delivery systems when utilized shall supply Grade D breathing air and shall conform to all other requirements contained in 29 CFR 1910.134, as a minimum. The CIH shall be responsible for ensuring the air intake for air compressors/movers is located so that no hazardous dusts, mists, fumes, or vapors are entrained into the air supply. Testing of supplied air, as required by 29 CFR 1910.134, shall be conducted by the contractor periodically.

2.4.1.2 Respirator Use: Respirators shall be worn at all times in the ACM control area while the following activities are being performed.

2.4.1.2.1 During area preparation when activities may result in contact with ACM.

2.4.1.2.2 During any material or equipment removal when ACM may be disturbed, including removal of light fixtures, cables, suspended ceiling panels and grids, duct work, or any other building appurtenance.

2.4.1.2.3 When installing walls or barriers, or making structural modifications by sawing, hammering, drilling, etc., that could cause abrasion, cutting, shock or vibration to ACM.

2.4.1.2.4 In the ACM control area after the area has been prepared, while ACM removal and cleanup operations are being performed.

2.4.1.2.5 In the loading and ACM control area while handling bags or sealed containers and while loading them into the truck.

2.4.1.2.6 While unloading bags/containers at the landfill and placing them in the landfill.

2.4.1.2.7 After ACM has been removed and an area has passed visual inspection and final clearance air monitoring, respirators no longer need to be worn in that area.

2.4.1.3 Respirator Fitting and Training: The Contractor shall implement and maintain a Respiratory Protection Program in accordance with 29 CFR 1910.134 and 29 CFR 1926.1101. This program shall be described in detail in the ACM Removal and Disposal Plan and shall incorporate the following elements, as a minimum:

2.4.1.3.1 Respirator Training: Employees shall be instructed in the selection, wearing, limitations, cleaning, storage and maintenance of the types of respirators they will be using.

2.4.1.3.2 Qualitative Fit Testing: Each employee shall be qualitatively fit-tested every six months as a minimum with the respirators they are issued to ensure proper protection. Fit-testing shall be performed using isoamyl acetate ampoules, irritating smoke tubes, or equivalent methods according to 29 CFR 1926.1101, Appendix C for qualitative testing. Qualitative fit testing will be permitted only for half-facepiece air purifying respirators. For negative-pressure air-purifying respirators providing greater protection than half-facepiece respirators, quantitative fit-testing shall be required. If necessary, the employee shall be given a choice of face piece sizes or styles and respirator brands in order to ensure an adequate fit. Any facial hair that may interfere with the face piece seal shall be removed prior to fit testing and actual respirator use. In addition, employees shall perform positive/negative pressure fit tests on half mask and full-face piece air purifying respirators each time they are put on, in accordance with manufacturer's instructions.

2.4.1.3.3 Respirator Storage: Respirators and filter cartridges shall be stored in a place and manner that they cannot become contaminated with ACM. New cartridges shall be installed each time a worker enters the ACM control area.

2.4.2 Protective Clothing: All personnel engaged in ACM removal work shall wear approved disposable protective clothing constructed of spun-bonded olefin or polypropylene fabrics, or other material of equivalent resistance to penetration by ACM. A full body suit is recommended in lieu of a separate set of coveralls, head covers, and shoe covers. Disposable whole body clothing including head covers, gloves, and shoe coverings shall be provided to and worn by all persons in the ACM control area. If elastic sleeve enclosures are not provided, sleeves shall be secured with duct tape to gloves. Footwear having a non-skid tracking surface shall be provided and used by all personnel within the ACM control area. Contaminated clothing shall be treated as ACM and undergo the same disposal procedures. All disposable clothing shall be flame-retardant. All openings in clothing shall be immediately taped to exclude penetration by asbestos fibers.

2.4.3 Protective Clothing for Use by the Government: The Contractor shall, at all times, have available for use by the Contracting Officer or his representatives three clean sets of safety equipment, (including appropriate respirators, and disposable protective clothing). The items shall be stored in the "clean room" and clearly marked: FOR USE BY GOVERNMENT ONLY.

2.5 WARNING LABELS AND SIGNS: Warning labels and signs shall conform to 29 CFR 1926.1101.

2.5.1 Signs: The Contractor shall post warning signs at the perimeter of the ACM control area prior to ACM removal in accordance with 29 CFR 1926.1101. The signs shall display the legend indicated below.

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

2.5.2 Labels: The Contractor shall permanently affix warning labels to all products and bags/containers containing or contaminated with ACM in accordance with 29 CFR 1926.1101 and 49 CFR 171 and 172. Labels shall be printed in large bold letters on a contrasting background and contain the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

and

RQ HAZARD
SUBSTANCES
SOLID, NOS.
ORM-E NA9188
(ASBESTOS)

2.6 OTHER MATERIALS AND EQUIPMENT: Other materials and equipment such as those used to construct worker decontamination enclosure system and isolation barriers shall be new, or used, uncontaminated with ACM, and in serviceable condition, and the appropriate items for the intended purpose.

PART 3 EXECUTION

3.1 GENERAL: (FOR LUMP SUM CONTRACT) Remove and dispose of ACM including vinyl-asbestos floor tile and insulation on domestic water and HVAC piping systems, boilers, and related components and equipment as indicated on the Removal Schedule at the end of this section and specified herein. When the actual quantities of ACM removed varies more or less than 10 percent of the estimated quantities indicated on the Removal Schedule a Contract cost adjustment will be negotiated with the Contractor. Removal and disposal of ACM shall include all special ACM removal and disposal materials and equipment, worker protective clothing and equipment, air monitoring, and construction of worker decontamination enclosure system, a loading area, and isolation barriers necessary to accomplish the required work.

or

3.1 GENERAL: (FOR REQUIREMENTS CONTRACT) Test for asbestos content, and remove and dispose of ACM from interior and exterior building surfaces in the quantities indicated on Delivery Orders as specified herein. Delivery Orders will designate locations and items of work to be accomplished. Removal and disposal of ACM shall include all special ACM removal and disposal materials and equipment, worker protective clothing and equipment, air monitoring, and construction of worker decontamination enclosure system, a loading area, and isolation barriers necessary to accomplish the required work.

or

3.1 GENERAL: (FOR TOTAL HOUSING MAINTENANCE CONTRACT) Test for asbestos content, and remove and dispose of ACM from interior and exterior building surfaces as part of Work Level III - Specific Ordered Items of Maintenance, Repair, and Incidental Improvement as specified herein. Delivery Orders will designate locations and items of work to be accomplished for Work Level III. Unit Prices for ACM removal and disposal shall include all costs associated with removal and disposal ACM except for testing and air monitoring. These tasks will be paid for separately.

3.2 PREPARATION FOR REMOVAL: Prepare the work site and protect workers in accordance with 29 CFR 1926.1101, 40 CFR 61 Subparts A and M, KAR 28-50, and EM 385-1-1.

3.2.1 Preparation for Gross Removal:

3.2.1.1 Accessibility of Work Areas: The Government shall rearrange equipment and areas to the extent of providing a reasonable, direct and unobstructed path to the work sites. During ACM removal the Contractor shall 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 shall not be permitted. Where conflicts arise due to Contractor's operations, the decision of the Contracting Officer or his authorized representative shall be final.

3.2.1.2 Movable Furnishings: All movable furnishings, equipment and fixtures in the proposed work area shall be pre-cleaned with a HEPA filter equipped vacuuming device or wet cleaning methods. After cleaning, the items shall be removed from the work area and stored in an area that is not subject to contamination with asbestos fibers. The items shall not be returned to the work area until final room cleanup has been completed and passed visual inspection and final clearance air monitoring have successfully documented such.

3.2.1.3 Dusting and Vacuuming: All wall and floor surface areas, other than those from which ACM is to be removed, and all non-movable furnishings, equipment and fixtures remaining in the proposed work area shall be pre-cleaned with a HEPA filter equipped vacuuming device or wet cleaning methods prior to sealing with polyethylene sheeting.

3.2.1.4 Enclosed ACM Control Area Requirements: Areas in which gross ACM removal is to be performed shall be completely sealed from surrounding spaces. The Contractor shall completely seal all door and wall openings, grills, registers, diffusers, conduits, etc., with two layers of 6-mil polyethylene sheeting sealed with tape. After temporary barriers have been installed, a layer of at least 4-mil thick polyethylene sheet shall be installed on all walls. The floors shall be covered with a minimum of two layers of 6-mil thick polyethylene sheeting that extends up the walls beneath the wall layer at least 12 inches. Polyethylene sheeting on the walls shall be affixed to the wall in a manner that will assure that it will remain in position throughout the length of the project and shall overlap the floor sheeting at least 12 inches above the intersection of the walls with the floor. Any tears in the polyethylene sheeting shall be immediately repaired. All air locks will be at least three sheets deep. Care shall be taken to avoid disturbing ACM on ceilings, surfaces, pipes, equipment, ducts, or any dust accumulations while installing polyethylene sheets. Seal all equipment, either floor or wall mounted, with double 6-mil thick polyethylene sheets. Protect equipment from falling objects like tools, material, etc.

3.2.1.5 Non-enclosed ACM Control Area Requirements (Non-Friable Asbestos Only): The construction of sealed, enclosed ACM control area is impractical and not required for the removal of non-friable asbestos, specifically as indicated on the removal schedule. Provide a 20-foot roped-off and labeled perimeter around the area where the non-friable asbestos is to be removed and handled. Non-authorized personnel are not to be permitted within the area until cleared by the CIH and Contracting Officer. Activities which could be expected to cause this material to become friable, cutting, drilling, sanding, etc., are prohibited. Prior to beginning the removal of this material, secure the HVAC system and seal off vents, grills, and ducts with two sheets of polyethylene sheeting; and thoroughly wet the non-friable asbestos containing material with amended water. Personnel within the non-enclosed ACM control area shall wear respiratory protection and protective clothing consistent with other provisions of these specifications. Additionally, a change room shall be provided in the near vicinity of the abatement area.

3.2.1.6 Worker Decontamination Enclosure System: The Contractor shall furnish material and labor for the construction of a worker decontamination en-

closure system consisting of an equipment room, a shower area, and a clean room. The rooms shall be of a sufficient size to accommodate the Contractor's operation within. The rooms shall receive the same masking/sealing treatment as the ACM control areas. Worker decontamination enclosure systems shall be physically attached to the ACM control area to prevent ACM workers from contaminating adjacent areas when leaving the control area.

3.2.1.6.1 The clean room shall be used to store ACM workers' street clothing and clean protective clothing and equipment, and to provide a dressing area for personnel and for the storage of foodstuffs. Contaminated clothing shall not be allowed in this room. Workers shall only enter this room from the outside dressed in street clothes, or naked from the shower.

3.2.1.6.2 The shower area shall be provided with at least one shower head that is supplied with hot and cold or warm water. Adequate quantities of soap, hair shampoo and towels shall be provided to accommodate each person who emerges from the ACM control area. The floor of the shower room shall be covered with a minimum of two layers of six mil thick polyethylene sheeting unless it is constructed of an impervious, easily washable material. Shower water shall be filtered for fibers greater than 5 micrometers in length. Debris collected in the filters shall be disposed as contaminated waste in accordance with KAR 28-50.

3.2.1.6.3 The equipment room shall be used to provide an intermediate area of lesser asbestos contamination for decontamination of contaminated items (tools and equipment) and personnel. This room shall be HEPA vacuumed or wet cleaned daily to avoid asbestos dust accumulations. Workers shall be HEPA vacuumed or wet cleaned from head to toe each time upon entering the equipment room from the asbestos control area. In case of emergency, aid for a seriously injured worker shall not be delayed for reasons of decontamination.

3.2.1.6.4 Loading Area: This area shall be separated from the ACM control area by an air lock. After this area is constructed, all materials going into or leaving the ACM control area shall be through this loading area. No person shall enter or exit the ACM control area from outside by passing through the loading area. The loading area shall be considered contaminated to the same degree as the ACM control area and shall be separated by a barrier from other areas of the building.

3.2.1.7 Air Pressure Levels at the Work Sites: After masking is installed and the ACM control area for gross removal is sealed, negative pressure shall be maintained within the ACM control area by the use of HEPA exhaust units exhausting to the outside of the building that provide a minimum of four (4) air changes per hour through the ACM control area. The calculation of the number of units required shall be based upon each exhaust unit's demonstrated air moving rate under working conditions. The number of required units shall not be calculated solely on air moving claims made in manufacturer's literature. Volumeteric air flow calculations shall be recorded daily. Negative pressure levels within the ACM control area shall be continuously maintained (at a minimum of minus 0.02 inch water column relative to adjacent unsealed areas); and monitored and recorded by a 24-hour strip or circular chart instrument, throughout the duration of the abatement operations. The CIH/IHT shall date, record the abatement site, and submit all recordings to the Contracting Officer at the beginning of the working day following the recording. Equipment used for producing a negative pressure shall have filtering in conformance with ANSI Z9.2 on the exhaust side and shall operate 24 hours per day during the removal process and decontamination phases, until clearance air monitoring is completed and satisfactory results are received from the lab. The Contractor shall immediately replace any negative air pressure equipment which breaks down and shall immediately notify the CIH and the Contracting Officer of any such breakdown. Whether or not the Government is providing electrical power

to operate the negative pressure equipment, the Contractor shall have independent power available in case of loss of the primary power.

3.2.2 Preparation For Glove Bag Removal:

3.2.2.1 ACM Control Area Requirements: Install temporary barriers to completely seal openings, grills, registers, diffusers, conduits, etc., within the perimeter area, with polyethylene sheeting and tape. Temporary sealing barriers shall have a minimum of two layers of 6-mil thick polyethylene sheets. Care shall be taken to avoid disturbing ACM while installing polyethylene. Provide a 20-foot diameter roped-off and labeled perimeter around the area where the glove bag is to be used.

3.2.2.2 Movable Furnishings: All movable furnishings, equipment and fixtures in the proposed work area shall be pre-cleaned with a HEPA filter equipped vacuuming device or wet cleaning methods. After cleaning, the items shall be removed from the work area and stored in an area that is not subject to contamination with asbestos fibers. The items shall not be returned to the work area until final room cleanup has been completed and, visual inspections and final clearance air monitoring have successfully been documented such.

3.2.2.3 Protect Floors and Walls: Protect floors and walls next to pipes with 6-mil polyethylene sheeting and mist the sheets with amended water or removal encapsulant prior to and during removal.

3.2.2.4 Worker Decontamination Enclosure System: A worker decontamination enclosure consisting of a clean room and a equipment room shall be provided by the Contractor, and used by personnel engaged in glove bag removal, no shower shall be required for glove bag removal.

3.2.3 Prohibited Activities: Smoking, eating, and drinking, as well as transport/storage of food or tobacco into ACM work areas, in the equipment room, or the shower area, shall not be permitted at any time.

3.2.4 Temporary Power and Lighting: All electrical circuits and lights in or affected by the ACM control area shall be de-energized. It is the Contractor’s responsibility to provide labor and materials to maintain temporary power and lighting in the ACM control areas and in areas of the building where operations may be affected by the removal. Temporary electrical service utilized in the enclosure shall be connected to ground fault protected outlets located outside the enclosure.

3.2.4.1 Lighting: Natural lighting shall be supplemented as needed by portable lights located inside or outside the enclosure, as appropriate, in order to provide a well lighted work zone illuminated to a minimum intensity of 10 foot-candles. Temporary lights utilized inside the enclosure shall be suitable for the wet and asbestos contaminated environment involved with the gross removal operation.

3.3 REMOVAL: Remove ACM in accordance with 29 CFR 1926.1101, 40 CFR 61 Subparts A and M, and KAR 28-50.

3.3.1 General Handling And Removal Requirements:

3.3.1.1 Removal of Ceiling Panels: Where suspended ceiling panels must be removed to expose and make work areas accessible, remove ceiling panels within the work area progressively and carefully. Clean the panels using HEPA vacuum equipment and wet cleaning methods and wrap panels in two layers of 6-mil minimum thickness polyethylene and dispose of as contaminated waste.

3.3.1.2 Removal of Sheet and Sprayed Asbestos Insulation: To prevent emission of airborne fibers, the ACM shall be sufficiently saturated with amended water or removal encapsulant prior to scraping and removal. The amended water or removal encapsulant solution shall be applied with a low pressure spraying system. Over soaking shall be avoided to eliminate excessive runoff and control should be employed to avoid wetting ACM which will not be removed and be disposed of immediately. After properly wetting material throughout its entire thickness, detach or scrape asbestos materials from the ACM without allowing them to free-fall. After scraping, wet non-metallic brushes shall be used to remove residual visual fiber accumulations.

3.3.1.3 Removal of Asbestos Pipe Insulation: Pipe insulation shall be wetted with a fine mist of amended water or removal encapsulant prior to cutting and removal. After wetting the material, carefully slit the insulation over its entire length, cut the lagging at the pre-molded joints of the insulating material and remove from the pipe. If insulation is jacketed, remove the jacket and mist the insulation with amended water or removal encapsulant. The wet ACM shall be placed in a 6-mil polyethylene bag, or other approved impermeable container upon removal, with proper labeling, and sealed. Before loading into drums, this first bag shall be placed in a second 6-mil bag and sealed. The full bags shall be wet wiped and/or HEPA vacuumed before being loaded for disposal. Removal in each area shall proceed from the area nearest the decontamination enclosure system toward the negative air unit(s).

3.3.1.4 Demolition of Insulated Pipe: Where pipe and insulation are to be removed simultaneously, the following procedure shall be followed:

3.3.1.4.1 A section of insulation at least 6 inches wide shall be removed in accordance with the requirements of paragraph 3.3.1.3, Removal of Asbestos Pipe Insulation, and paragraph 3.3.3, Glove Bag Removal.

3.3.1.4.2 Exposed ends of the insulating material shall be sealed with polyethylene sheeting and tape.

3.3.1.4.3 The pipe shall then be cut into manageable length using a saw or torch.

3.3.1.4.4 The entire pipe shall be wrapped and sealed securely in two layers of 6-mil polyethylene sheeting, and properly labeled.

3.3.1.4.5 Disposal of demolished asbestos contaminated building components shall be as specified in paragraph 3.4.2, Disposal of ACM Waste Materials.

3.3.1.4.6 For demolition operations follow the air monitoring requirements in paragraph 3.5.4, Glove Bag Operations Requirements.

3.3.1.5 Cutting and Drilling of Nonfriable ACM: Cutting, drilling, abrading, or otherwise penetrating ACM will cause the material to become friable. Therefore, such activities shall only be conducted under controls and procedures outlined for handling friable asbestos-containing materials.

3.3.1.5.1 Before beginning any cutting or drilling, the surface of the ACM shall be thoroughly saturated with amended water or removal encapsulant.

3.3.1.5.2 Adequate local exhaust to capture fibers produced by cutting, drilling, abrading shall be provided by means of an approved HEPA vacuum. Specialized equipment such as drills or saws having integral ventilation hoods which are connected to an HEPA vacuum with a flexible hose shall be used. Local exhaust ventilation shall comply with ANSI Z9.2. HEPA filters and removed material shall be handled and disposed of as contaminated material.

3.3.1.5.3 Upon completion of cutting, drilling operations, edges of ACM exposed by cutting or drilling shall be sealed with two coats of an approved asbestos encapsulant sealer.

3.3.1.6 Removal of Vinyl Asbestos Floor Tile (VAT): For the removal of VAT, it is not required to cover walls and floors with polyethylene sheeting. The Contractor shall maintain all other requirements for asbestos enclosed areas for gross removal.

3.3.1.6.1 The VAT shall be thoroughly wetted prior to removal and maintained in a wet condition by misting with amended water or removal encapsulant applied with a low pressure spraying system.

3.3.1.6.2 Removal operations shall entail only the lifting of the VAT from the substrate. The VAT shall not be sanded, ground, sawed or abraded in manner which could cause a friable asbestos hazard.

3.3.1.6.3 As the VAT is removed, the debris shall be containerized immediately to prevent the material from drying out.

3.3.1.7 Exterior Non-Friable ACM Removal: Non-friable ACM exterior to a building shall be thoroughly wetted prior to removal and maintained in a wet condition by misting with amended water or removal encapsulant applied with a low pressure system. The materials to be removed shall not be sanded, ground, sawed, or abraded in any manner which could cause a friable asbestos hazard.

3.3.1.7.1 The Contractor shall pry up the non-friable ACM without breaking, shattering, or otherwise causing a friable asbestos hazard. It shall be the CIH's responsibility to require more stringent removal practices and procedures based on the CIH's evaluation of the friability of the asbestos containing material.

3.3.1.7.2 ACM shall not be permitted to fall to the ground, but shall be carefully placed while still wet, in two 6-mil sealable polyethylene bags or wrapped in two layers of 6-mil polyethylene sheeting sealed with tape, and properly labeled. The removed material shall be handled and disposed of as asbestos contaminated waste.

3.3.2 Gross Removal:

3.3.2.1 Worker Protection and Decontamination: The Contractor shall take all safety measures and precautions required to protect his employees and building occupants in accordance with 29 CFR 1926.1101, 40 CFR 61 Subpart M, and KAR 28-50. The Contractor shall provide his employees a worker decontamination enclosure system when required by and in accordance with 29 CFR 1926.1101, and KAR 28-50.

3.3.2.1.1 Each worker and authorized visitor shall, upon entering the job site, remove street clothes in the clean change room and put on an appropriate respirator and protective clothing before entering the equipment room or the ACM control area. When changing from street clothes to work clothes, the worker shall remove all street clothing and then dress in only the protective clothing, and the equipment specified in this section.

3.3.2.1.2 Each worker and authorized visitor shall, each time he leaves the ACM control area, remove gross contamination from clothing prior to entering the equipment room; proceed to the equipment room and remove all clothing except respirators and place disposable protective wear in a 6-mil polyethylene bag in the equipment room; still wearing the respirator, proceed naked to the

showers; clean the outside of the respirator with soap and water while showering; remove the respirator and dispose of filter cartridges; thoroughly shampoo and wash themselves; and wash and rinse the inside of the respirator.

3.3.2.1.3 Following showering and drying off, each worker and authorized visitor shall proceed directly to the clean change room and dress in street clothes or in clean coveralls before eating, smoking, drinking, or reentering the ACM control area, or leaving the ACM abatement project area.

3.3.2.1.4 Contaminated work footwear shall be stored in the equipment room when not in use in the ACM control area. Upon completion of ACM abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from ACM control area or from equipment room.

3.3.2.2 Embedded Items: Utility lines and other electrical or mechanical appurtenances embedded in the material shall be:

3.3.2.2.1 Temporarily loosened to permit cleanup of their surfaces and the surfaces from which they were removed. They shall be reinstalled, if they originate in the ACM control area but terminate outside, or if they pass through the ACM control area with origin and termination outside.

3.3.2.2.2 Removed and disposed of, if they will be replaced by renovation work.

3.3.2.3 Removal of Asbestos Contaminated Items: Contaminated architectural, mechanical and electrical appurtenances to be removed and disposed of such as venetian blinds, full-height partitions, carpeting, duct work, pipes and fittings, radiators, light fixtures, conduit, panels and other items shall be pre-cleaned with a HEPA filter equipped vacuum or wet cleaning methods, completely coated with an approved encapsulant sealer in the ACM control area before they are removed through the loading area. Thoroughness of sealing operations shall be visually gauged by the extent of colored coating on exposed surfaces.

3.3.3 Glove Bag Removal:

3.3.3.1 If glove bag removal is utilized, all ACM to be removed in the ACM control area shall be removed using at least 6-mil thick glove bags in accordance with the manufacturer’s instructions, 29 CFR 1926.1101, and the instructions contained herein. The Contractor shall use a two man team for each glove bag procedure. Both abatement workers shall be highly trained in using the glove bag technique.

3.3.3.2 Each section of the pipe or conduit from which damaged or loose friable ACM is to be removed that is not immediately enclosed within a glove bag shall be tightly enclosed in 6-mil thick polyethylene sheeting until a glove bag is placed over it and the ACM is removed. All pipes, conduits, etc. to which a glove bag will be attached shall be cooled below 100 degrees Fahrenheit prior to attaching the glove bag.

3.3.3.3 Each person using the glove bag shall avoid damaging or disturbing any other friable ACM located within the ACM control area that are not intended to be removed using the glove bag method.

3.3.3.4 Glove bags shall provide an air tight seal around the area from which the ACM is to be removed. Each glove bag seal shall be verified by the CIH/IHT for leakage by introducing smoke into the bag and then gently squeezing the bag with hand pressure. If any leaks occur, the bag shall be re-

sealed and re-tested, until no leakage occurs. This seal shall be continuously maintained until all of the ACM has been removed from the pipe or conduit surface that is enclosed within the glove bag and the encapsulant sealer has been applied to the piping and any raw edges of remaining insulation within the glove bag. No sliding or reusing of glove bags shall be allowed; glove bags are single-use control devices. To help prevent leakage during the removal process, the seams of the glove bags shall be reinforced with duct tape prior to the start of the process.

3.3.3.5 Friable ACM shall be saturated with amended water or removal encapsulant during removal and maintained in a wet condition until the glove bag is removed and sealed for final disposal in accordance with the requirements of KAR 28-50.

3.3.3.6 Appropriate warning signs shall be prominently posted at all entryways into the ACM control area. Provisions shall be made to prevent a person other than those persons that have responsibilities directly related to the project from entering the ACM control area before final cleanup is completed and approved in accordance with any special requirements applicable to this project.

3.3.3.7 Each person using the glove bag or occupying a work area where they are being used shall wear appropriate respirators and full protective clothing until the removal operations are completed and the pipes or conduits are sprayed with encapsulant sealer, and the glove bags have been removed from the pipe or conduit, and sealed shut.

3.3.3.8 Each project activity in the ACM control area shall be immediately discontinued if there is any asbestos contamination of the general work area as a result of damage or improper use of the glove bags or damage to any other friable ACM located within the area. Project activities shall not be resumed until all surfaces in the area that are likely to have become contaminated with asbestos fibers have been thoroughly cleaned with a HEPA filter equipped vacuuming device or by wet cleaning methods. The CIH/IHT shall be immediately notified in the event of such problems. The CIH/IHT shall evaluate the extent of the contamination and clean-up efficiency as well as recommend procedures to prevent recurrence. Each person who is likely to be contaminated with asbestos fibers resulting from these sources, including the cleanup operation, shall remove, or use a HEPA filter equipped vacuuming device or wet cleaning methods to clean all contaminated outer work clothing before leaving the ACM control area. The Contracting Officer shall be notified of the date and nature of such occurrences and the cleanup measures that were used before the project is completed.

3.3.3.9 After completion of ACM removal work by the glove bag method, prior to glove bag removal, all surfaces from which ACM has been removed shall be cleaned by wet cleaning methods or HEPA vacuumed. Surfaces shall then be sprayed with approved encapsulant sealer to firmly bond any fibers which may remain attached to the surface. After the glove bag is removed, a final visual inspection of the entire work area, where glove bag methods have been used, shall be conducted by the COR and the CIH or IHT prior to final clearance monitoring.

3.3.3.10 Upon completion of glove bag removal, wet wipe and/or HEPA vacuum all exposed surfaces, walls, columns, equipment etc., within the perimeter area.

3.3.3.11 Air tight seals provided for doors, windows and duct openings shall remain in place for a period of not less than 24 hours after completion of the final air monitoring and until the cleanup is approved in accordance with any other special requirements applicable to the project.

3.3.4 Cleanup: After completion of gross removal work, all surfaces from which ACM has been removed shall be brushed and cleaned by a HEPA filtered vacuum or wet cleaning methods, until the CIH or IHT and Contracting Officer's Representative (COR) are satisfied that no asbestos remains attached to the substrate. Do not dry sweep or blow down the area with compressed air. After all residue is removed and upon approval of the COR and IHT or CIH, the surfaces shall be sprayed with an approved encapsulant sealer to firmly bond any fibers which may remain attached to the surface. Wet clean, and/or HEPA vacuum all exposed surfaces, walls, columns, equipment, etc., within the ACM control area prior to conducting final visual inspection and final clearance air monitoring.

3.3.4.1 Following the spraying of surfaces with an encapsulant sealer, allow a minimum of 24 hours for drying. Remove the wall and equipment masking, lay it on the floor masking, take up the floor masking with the wall masking inside, fold roll the masking and put it into ACM waste drums lined with two layers of polyethylene bags, seal and install sealable lid and retaining ring. Retaining the temporary sealing barriers on opening to areas exterior of the ACM control area, such as windows, vents, ducts, etc., and clean the surfaces by wet cleaning or HEPA vacuum. Provide a minimum of 24 hours for surface drying and fiber settling and removal. Use a high-speed air blower to redistribute any remaining fibers (minimum of 5 minutes per 1,000 square feet of surface area). Proceed with aggressive final clearance air monitoring, as specified in paragraph 3.5.3, Final Clearance Requirements. Allow an additional 24 hour period for continued airborne fiber removal.

3.3.4.2 If the air samples exceed the values in paragraph 3.5.3, Final Clearance Requirements the CIH or IHT shall immediately notify the Contractor and the Contracting Officer of the results and recommend further specific corrective actions to be taken. The Contractor shall take immediate measures to reclean the area to reduce the airborne fiber concentrations to the specified clearance level at no additional cost to the Government.

3.3.4.3 Air tight seals provided for doors, windows and duct openings shall remain in place for a period of not less than 24 hours after completion of the final clearance air monitoring and until the cleanup is approved in accordance with any other special requirements applicable to the project.

3.3.4.4 Should areas outside the work area become contaminated with ACM dust or debris as a consequence of the Contractor's work practices, the Contractor shall be responsible for immediately cleaning these areas in accordance with the procedures indicated in this specification. This additional cleaning shall be at the Contractor's expense.

3.3.4.5 The Contractor shall perform a daily cleaning of any area outside the work area which, not withstanding the specifications contained herein, becomes visibly contaminated with airborne or tracked-in dust or debris as a consequence of work performed on that day.

3.4 COLLECTION AND DISPOSAL: Collect, transport, and dispose of ACM in accordance with 40 CFR 61 Subparts A and M, 49 CFR 172 Subpart B and C, 49 CFR 173 Subpart M, and KAR 28-50.

3.4.1 Collection of ACM Waste Materials: For the purposes of this paragraph ACM waste materials are all items not sealed with an ACM sealer at the job site. Collect ACM upon removal in 6-mil polyethylene bags or other approved impermeable containers. Use a fine spray of amended water or removal encapsulant to keep ACM in waste containers damp to minimize airborne dust. Pack ACM, while still wet, in bags/containers. Seal containers containing ACM with

a lid at all times at the work site. Affix warning labels having waterproof print and permanent, waterproof adhesive to bags/containers.

3.4.2 Disposal of ACM Waste Materials: Turn in bags/containers containing ACM at the Installation Construction Debris Landfill (CDL) as soon as practical. Store bags/containers in loading area prior to transporting and turn in. Procedures for transporting and turn in shall comply with 40 CFR 61 and KAR 28-50.

3.4.2.1 Trucks transporting bags/containers shall be totally enclosed to prevent loss or damage to bags/containers enroute to the CDL.

3.4.2.2 Bags/containers will not be accepted by the CDL if they have been broken or damaged. Overpack damaged bags in additional 6-mil polyethylene bags and/or reseal damaged containers in undamaged containers. Workers unloading bags/containers at the CDL shall wear respirators and appropriate personal protective equipment.

3.4.2.3 Prepare and sign a Waste Shipment Record (WSR) for each load of bags/containers turned in to the CDL. Ensure WSRs are completed by the transporter and the CDL.

3.4.2.4 Ensure containers and vehicles used to transport hazardous waste materials are labeled as outlined herein.

3.4.2.5 Dispose of items from which ACM has been removed, cleaned, and coated with an encapsulant sealer as uncontaminated waste, or handled as salvable material.

3.5 AIR MONITORING REQUIREMENTS: Perform air monitoring in accordance with 29 CFR 1926.1101. The Contractor’s is responsible for the development and implementation of an air monitoring program in accordance with good industrial hygiene practices and the requirements herein for. Air monitoring may be performed by Industrial Hygiene Technician approved by the Contractor’s CIH. Documentation of air sampling shall include as a minimum, calculations of minimum sample volume to achieve necessary detection limits; sampling times; sampling locations, with appropriate diagrams; evidence of periodic inspection of sampling equipment; documentation of daily pre- and post-calibration of sampling equipment; detailed description of work conditions and activities underway during the sampling period; description of worker protection devices; descriptions of any atypical environmental conditions; and a description of work practices/procedures/ controls in operation during the sampling period. Documentation of sample analysis shall include, as a minimum, sample identification; total sample duration, sample flow rate; the "Limit of Reliable Quantification" (LRQ); total air volume; total fibers counted (with work sheets); total fields counted; blank filter analysis; reticle field area; and fiber concentration in fibers per cubic centimeter (f/cm^3) calculated at the 95 percent confidence level.

3.5.1 Pre-Removal Requirements: Air samples shall be taken at least one day prior to cleaning and removal of furnishings or other items from the ACM control area and prior to masking and sealing operations. One air sample shall be taken per 10,000 cubic feet within the ACM control area, but a minimum of one air sample per discrete work area shall be taken. Fiber counts from these samples shall establish the reference background fiber concentrations for each location where ACM is to be removed.

3.5.2 During Removal Operations Requirements:

3.5.2.1 General: At least one full shift sample per work shift from each of the following locations shall be taken during ACM removal, demolition and decontamination operations:

3.5.2.1.1 Personal Exposure Air Samples: Inside the ACM control area during removal and cleanup operations. Full shift personal exposure air sampling of workers shall be performed to establish the 8-hour time weighted average (TWA) exposure for each employee in each work area, during removal, cleanup, and site preparation. Similarly, the 30-minute Excursion Limit (EL) shall be monitored. The CIH shall notify the Contractor and the Contracting Officer immediately of any exposures to asbestos fibers in excess of 0.1 f/cm^3 TWA or 0.5 f/cm^3 EL.

3.5.2.1.2 Barrier/Perimeter Air Samples: Immediately outside the ACM control area near all major openings to other building areas; (such as doors and/or windows sealed with temporary barriers). If monitoring anywhere outside the ACM control area, barrier/perimeter, environmental, and clean room air samples, indicates airborne concentrations in excess of 0.01 f/cm^3 or the reference background concentration, whichever is greater, stop the operation, investigate, and correct the condition causing the increase and notify the Contracting Officer and CIH immediately.

3.5.2.1.3 Environment Air Samples: Downstream of the negative air pressure exhaust during removal and cleanup operations.

3.5.2.1.4 Clean Room Air Samples: Inside the clean room during removal and cleanup operations.

NOTE: Area air samples (Barrier, Environmental, and Clean Room) shall be positioned so that the filter cassettes are not unduly affected by air currents or dead air spaces, such as from the HEPA exhaust units or in a corner of a room.

3.5.3 Final Clearance Requirements: At least 24 hours after final cleanup and decontamination following gross removal, remove the final polyethylene sheeting (leaving in place that polyethylene sheet covering opening exterior to the ACM control area, such as doors, windows, air ducts, etc.). Final clearance air monitoring using EPA aggressive air sampling procedures shall be conducted inside the ACM control area for airborne asbestos fibers. Aggressive air sampling shall consist of blowing down all surfaces with a leaf blower (minimum of 5 minutes per 1,000 square feet), using 20-inch fans (one fan per 10,000 cubic feet, placed in the center of space, air flow directed towards the ceiling, operating on slow speed, running continuously throughout the duration of air sampling) to stir the air. This monitoring shall be performed following final inspections by the COR and the IHT/CIH. For glove bag removal, non-aggressive clearance sampling may be conducted immediately following surface cleaning, encapsulation and final visual inspection. One air sample shall be taken per 10,000 square feet within the ACM control area, but a minimum of one air sample shall be taken per discrete work area. Sample volumes shall be as specified in paragraph 3.5.5, Sampling Volumes and Rates. Fans shall be used to aggressively circulate the air throughout the ACM control area during the final clearance air monitoring effort. Sample cassettes shall be positioned so they are not unduly affected by air currents or dead air spaces, such as from the HEPA exhaust units or in a corner of a room. The fiber counts from these samples shall not exceed the minimum clearance concentration level of 0.01 fiber greater than 5.0 micrometer in length per cubic centimeter of air, or not be greater than the lowest reference background fiber concentration established in paragraph 3.5.1, Pre-Removal Requirements, for the area, whichever is less. Exceeding these values constitutes evidence that cleanup has not been effectively accomplished, and the CIH shall immediately notify both the Contractor and the COR of these results and recommend

further specific corrective actions to be taken. The Contractor shall take immediate measures to re-clean the area to reduce the airborne fiber concentrations to the specified clearance level at no additional cost to the Government. Following final inspections and clearance air monitoring, but before the ACM control area is turned over for unrestricted use, when personal protective equipment is no longer required, the following statement shall be provided, signed and dated, including ABIH certification number, by the CIH:

> I hereby certify that abatement procedures, inspections, and air monitoring/sampling were performed in strict compliance with applicable standards and regulations. Based on my assessment, this area is cleared for unrestricted entry.

_____
(Signature of ABIH Certified Hygienist)

3.5.4 Glove Bag Operations Requirements: For glove bag operations, only the following type samples are required:

3.5.4.1 Pre-Removal.

3.5.4.2 Personal.

3.5.4.3 Final Clearance: Final clearance monitoring shall not be required provided none of the personal air samples collected in the ACM control area indicates airborne fiber concentrations exceeding 0.01 fibers greater than 5 micrometers in length per cubic centimeter of air or not greater than the referenced background fiber concentration, which ever is less.

3.5.5 Sampling Volumes and Rates: Sampling periods and volumes shall conform to NIOSH Method 7400. The minimum sample volumes (in liters) and maximum sampling rates (in liters per minute) shall be as indicated below:

Type Sample	Minimum Volume in Liters	Maximum Rate in Liters per Minute
Pre-removal Area Monitoring	2,400	10.0
Personal Exposure Monitoring	**	2.5
Barrier Monitoring	2,400	10.0
Environment Monitoring	2,400	10.0
Clean Room Monitoring	2,400	10.0
Final Clearance Monitoring	2,400	10.0

If during any sampling period the filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started.

****Note:** Enough air samples shall be taken to represent an 8-hour work day. The minimum flow rate shall be 0.5 liters per minute (l/min).

3.5.6 Method of Sampling and Analysis: Air samples shall be collected and analyzed according to NIOSH Method 7400, "A" counting rules, or OSHA reference method, 29 CFR 1926.1101, Appendix A. Fiber counting shall be performed at an accredited laboratory by an analyst who has demonstrated acceptable proficiency in the last round of NIOSH PAT samples for asbestos. Analytical results shall be calculated and reported at the 95 percent Confidence Level. The precision value to be used for calculating the 95 percent Confidence Level shall be .45, unless the analytic laboratory provides the Contracting Officer with documentation (i.e., Round Robin Program participation and results) that the lab’s precision is better.

3.6 RECORDKEEPING: Prepare and maintain accurate records of air monitoring in accordance with 29 CFR 1910.120 and 29 CFR 1926.1101 and disposal of ACM in accordance with 40 CFR 61 Subparts A and M. Prepare and submit within 15 working days after completion of the action the following:

3.6.1 Negative air pressure readings, signed and dated, documented as per paragraph 3.5.2, During Removal Operations Requirements.

3.6.2 Detailed air monitoring records, signed and dated, documented as per paragraph 3.5.2, During Removal Operations Requirements.

3.6.3 Final clearance statement prepared by the CIH, signed and dated, as per paragraph 3.5.3, Final Clearance Requirements.

3.6.4 Proof of proper disposal (Waste Shipment Record) of all ACM or ACM contaminated materials, signed and dated.

3.6.5 ENG Form 4921 completed and signed by the CIH.

3.7 CLEANUP: Maintain work sites in clean, orderly, and safe condition during the course of the work, and perform final cleanup upon completion of the work in accordance with 29 CFR 1926.1101, 40 CFR 61 Subpart M, KAR 28-50, and EM 385-1-1.

4.1 ASBESTOS CONTAINING MATERIALS REMOVAL (AND REINSULATION) SCHEDULE: When the actual quantities of ACM removed varies more or less than 10 percent of the estimated quantities indicated on the schedule a contract cost adjustment will be negotiated with the Contractor.

Material Description	Percent Asbestos	Material Location	Estimated Quantity	Unit
Vinyl-Asbestos Floor Tile	6	Living Room & Closets; Apt 1	235	SF
Boiler/Tank Insulation	50	Mechanical Room	105	SF
3/4" Dia. Pipecover	20	Laundry	15	LF
1-1/2" Dia. Pipecover	20	Mechanical Room	39	LF
3" Dia. Pipecover	20	Laundry	15	LF
1/2" Dia. Mudded Joint Packing	25	Apartment Bathrooms; 16 Each	54	LF
3/4" Dia. Mudded Joint Packing	30	Mechanical Room	48	LF
1-1/2" Dia. Mudded Joint Packing	30	Mechanical Room	25	LF
3" Dia. Mudded Joint Packing	30	Laundry	13	LF

DIVISION 2 - SITEWORK

SECTION 02223

EXCAVATION, FILLING AND BACKFILLING FOR PAVING, STRUCTURES AND UTILITIES

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for accomplishment of excavation, filling, and backfilling required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standards:

B31.9 Building Services Piping.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

D1556 Test Method for Density and Unit weight of Soil in Place by the Sand-Cone Method.

D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft (2,700 kN-m/m)).

D2216 Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.

D2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

D2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.2.3 International Association of Plumbing and Mechanical Officials (IAPMO) Publication:

Uniform Plumbing Code (UPC).

1.2.4 National Association of Plumbing-Heating-Cooling Contractors (NAPHCC) Publication:

01 National Standard Plumbing Code (NSPC).

1.2.5 National Fire Protection Association (NFPA) Publications:

70 National Electrical Code (NEC).

1.3 SUBMITTALS:

1.3.1 Test Results: Submit moisture density relationship test and compaction test results as specified in Paragraph: COMPACTION TESTING.

1.3.2 Application for DA Radiation Authorization or Permit: Submit DA Form 3337, Application for Department of the Army Radiation Authorization or Permit, 30 days prior to use of nuclear density testing equipment.

PART 2 PRODUCTS

2.1 MATERIALS: Materials shall conform to the requirements specified herein.

2.2 SATISFACTORY MATERIALS: Satisfactory materials include materials classified in ASTM D2487 as GW, GP, SW, GM, GC, SP, SM, CL, and ML. All other classifications in ASTM D2487 are considered to be unsatisfactory and shall not be used without prior approval of the Contracting Officer.

2.3 FILL MATERIALS: Fill materials shall be one or more of the satisfactory classifications listed above.

2.4 TOPSOIL MATERIALS: Topsoil material shall be of such quality that it will support healthy plant growth.

2.5 PLASTIC WARNING TAPE: Plastic warning tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise with an elongation factor of 350 percent. 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 4 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The 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 below and shall bear a continuous printed inscription describing the specific utility.

Type of Utility	Color
Electrical Power Lines, Cables, Conduit, and Lighting Cables	Red
Gas, Oil, Steam, Petroleum or Gaseous Materials	Yellow
CATV, Communications, Alarm or Signal Lines, Cables or Conduit	Orange
Water, Irrigation and Slurry Lines	Blue
Sanitary Sewers, Storm Sewers and Drain Lines	Green

PART 3 EXECUTION

3.1 GENERAL: Perform excavation, filling, and backfilling for paving, structures and utilities as indicated on the plans and specified herein. Excavation shall conform to the dimensions and elevations indicated on the plans and shall include trenching for utilities and foundation drainage systems. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory materials encountered below the grades indicated shall be removed and replaced with satisfactory material. Satisfactory material removed below the depths indicated without specific approval of the Contracting Officer shall be replaced at no 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.

3.2 MARKING UTILITIES: Not less than 3 or more than 10 workdays prior to the actual day of excavation on each site contact Kansas One-Call System, Inc., Toll Free 1-800-344-7233 and obtain a Kansas Dig-Safe Ticket Number. Immediately after obtaining a Kansas Dig-Safe Number contact Fort Riley Dig-Safe Coordinator at Public Works, Building 337, Phone 1-913-239-8187, FAX 1-913-239-8188 and accomplish the items listed below. No exceptions to this policy will be tolerated. The Contractor will be held liable for all costs incurred by various underground utility owners for repairs to damaged underground utilities resulting from failure to comply with this procedure.

3.2.1 Provide Kansas One-Call System Ticket Number.

3.2.2 Provide company name, name and telephone number of point of contact.

3.2.3 Provide a site drawing with measurements from nearest building showing depth and nature of work.

3.2.4 Mark the area to be dug with white paint.

3.3 EXCAVATION PERMITS: Obtain an excavation permit for each site from the Fort Riley Dig-Safe Coordinator at Public Works, Building 337, after the requirements in paragraph 3.2 above have been accomplished. Permits must be obtained before excavation begins. All requests shall be submitted not less than 3 workdays prior to the day of excavation.

3.4 UTILITY TRENCHES: Trenches for underground utilities systems shall be excavated to the required alignments and depths. The bottoms of trenches shall be graded to obtain the required slope, and shall be excavated so that the pipe or cables will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth 6 inches below the bottom of the pipe or cable, and the overdepth shall be backfilled with sand or other satisfactory material.

3.5 DRAINAGE: Excavation shall be performed so that the area of the site and the area immediately surrounding the site and affecting operations at the site will be continually and effectively drained.

3.6 SHORING: Shoring, including sheet piling, shall be furnished and installed by the Contractor 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.

3.7 CLASSIFICATION OF EXCAVATION: Excavation will be unclassified regardless of the nature of material encountered.

3.8 BLASTING: Blasting will not be permitted.

3.9 BORROW: Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials may be obtained from designated borrow areas on-post. The Contracting Officer will provide the location of on-post borrow areas if borrow materials are required. Borrow areas shall be neatly trimmed and drained after borrow excavations are completed.

3.10 EXCAVATED MATERIALS: Satisfactory material in excess of that required for the permanent work and unsatisfactory materials may be disposed of in designated fill areas on-post. The Contracting Officer will provide the location of on-post fill areas if fill areas are required.

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.

3.12 PREPARATION OF SURFACES: Unsatisfactory materials in areas to receive fill shall be removed and replaced with satisfactory materials. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than one 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 6 inches, 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 12 inches and compacted as specified for the adjacent fill.

3.13 FILLING: Satisfactory materials free from roots, debris or stones larger than 3 inches shall be used in bringing fills to the lines and grades indicated, and for replacing unsatisfactory materials. Satisfactory material shall be placed in horizontal layers not exceeding 8 inches in loose depth and then compacted. Material shall not be placed on surfaces that are muddy, frozen, or contain frost.

3.14 BACKFILLING: Backfilling shall not begin until construction below finish grade has been approved, and the excavation cleaned of trash and debris. Backfill shall not be placed in wet or frozen areas. Backfill shall be of satisfactory materials placed and compacted as specified herein. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 2 feet above sewer lines and 1 foot above other utility lines shall be free from stones larger than 1 inch 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 4 inches in compacted thickness with power-driven hand tampers suitable for material being compacted. Backfill shall not be placed against foundation walls prior to 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. Bright colored plastic underground utility warning tape shall be buried 1 foot below finished grade with all underground utilities installed in this project.

3.15 SUBGRADE PREPARATION:

3.15.1 Shaping: After the subgrade has been shaped to line, grade and cross section, the subgrade shall be rolled until thoroughly compacted, as specified, with an approved roller weighing not less than 10 tons. This operation shall include any reshaping and wetting or aerating required, along with rolling of the subgrade, to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material from excavation or borrow, or with the materials specified for spot subgrade reinforcement, as directed. All boulders or ledge stone encountered in the excavation shall be removed or broken off to a depth of not less than 6 inches below the subgrade. The resulting low area and all other low sections, holes, or depressions shall be brought to the required grade with approved material, and the entire subgrade shaped to line, grade, and cross section and thoroughly compacted as herein provided.

3.15.2 Compacting: Subgrade compaction shall be extended to include the shoulders for a distance of at least 1 foot beyond the edges of the base course. The zone of subgrade compaction shall extend to a depth of 6 inches for cuts and 6 inches for fills. The layer or layers of subgrade material shall be compacted as specified in Paragraph: COMPACTION. If in cut sections the required subgrade densities cannot be obtained throughout the compaction zone by rolling the top layer only, the natural in-place density of the under-

lying portion shall be brought to the required percentage of density by removal, replacement, and compaction, layer by layer, if necessary, as determined by the Contracting Officer.

3.15.3 Finishing: The subgrade shall be struck off with approved planers, subgraders, or other equipment, and the surface shall be thoroughly compacted with flat rollers weighing not less than 10 tons. When required, sufficient water shall be applied to consolidate the surface of the subgrade properly. After the rolling, the surface of the subgrade shall not show any deviation in excess of 1/2 inch when tested with a 10 foot straightedge applied both parallel to and at right angles to the center line of the area. The elevation of the finished subgrade shall conform to the elevations shown.

3.15.4 Protecting: The finished subgrade shall not be disturbed by traffic or other operations and shall be protected and maintained by the Contractor in a satisfactory condition until the base course is placed.

3.16 SPOT SUBGRADE REINFORCEMENT:

3.16.1 Material: Material for spot subgrade reinforcement shall consist of one of the following types with necessary filler: sound, tough, durable crushed stone; slag; gravel; or other approved material. The crushed stone, slag, or gravel shall consist of pieces varying from 1 inch to 3 1/2 inches in diameter. When a finer material is necessary for filler, broken-stone chips, screened gravel, or sand may be used to fill voids. Spot subgrade-reinforcement material shall be subject to approval by the Contracting Officer.

3.16.2 Construction Methods: Unsuitable subgrade materials shall be removed, the bottom of the resulting excavation shaped uniformly and compacted firmly to the density specified, and the required provisions for adequate drainage shall be made. The subgrade-reinforcement material consisting of slag, gravel, or crushed stone shall then be placed in the preparation in layers of not more than 5 inches. Each layer shall be spread and compacted. Succeeding layers shall be placed until level with the surrounding-subgrade surface. The voids shall then be filled with the finer selected material and the work rolled, or tamped if inaccessible to the roller. The filling and rolling or tamping shall continue until the entire mass is thoroughly compacted to not less than the density of the adjacent areas. The surface shall be finished to conform accurately to the grade and cross section indicated.

3.17 COMPACTION: Degree of compaction required is expressed as a percentage of the maximum laboratory dry density obtained by the test procedures presented in ASTM D1557 and ASTM D2216. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the task and soil being compacted. Material shall be moistened or aerated to obtain the moisture content necessary to obtain the specified compaction with the equipment used. Each lift shall be compacted to not less than the percentage of maximum laboratory dry density indicated below.

Type of Material and Location	Minimum Degree of Compaction
Structural Fill Placed in Support of Pavement More Than 12 Inches Below Finished Subgrade	90 Percent of Maximum Laboratory Dry Density at a Moisture Content of Minus 1 to Plus 4 Percent From Optimum
Structural Fill Placed in Support of Pavement Within 12 Inches of Finished Subgrade	93 Percent of Maximum Laboratory Dry Density at a Moisture Content of Minus 1 to Plus 4 Percent From Optimum
Crushed Aggregate Base and Surface	95 Percent of Maximum Laboratory Dry

Courses	Density at a Moisture Content of Minus 1 to Plus 4 Percent From Optimum
Structural Fill Placed in Support of Floor Slabs and Foundations	95 Percent of Maximum Laboratory Dry Density at a Moisture Content of Zero to Plus 4 Percent From Optimum
Non-Structural Fill Placed in Non-Structural Supporting Areas Such as Seeded or Spoil Areas	85 Percent of Maximum Laboratory Dry Density at a Moisture Content of Minus 1 to Plus 4 Percent From Optimum

3.18 COMPACTION TESTING: Compaction testing shall be performed by an approved commercial testing laboratory at the expense of the Contractor in accordance with ASTM D1556 or ASTM D2922. Moisture density relationship tests shall be performed on each soil type encountered on the worksite which is subject to compaction. Compaction tests shall be performed in sufficient number to ensure that the specified degree of compaction is being obtained. One compaction test shall be performed in randomly selected locations for every 100 square yards of fill area. One compaction test shall be performed for every 500 lineal feet of utilities installed. When test results indicate that materials or installation do not conform to the requirements herein, the material shall be removed, replaced, recompacted, and retested at no expense to the Government. The Government reserves the right to perform its own tests to verify conformance to Contract requirements. Nuclear density testing equipment shall not be operated without obtaining a Radiation Permit from the Fort Riley Radiation Protection Officer.

3.19 INSTALLATION OF UTILITIES: Installation of underground electrical utilities shall conform to the applicable portions of NFPA 70. Installation of sanitary and storm sewer systems shall conform to the UPC or NAPHCC 01. All installations of utilities shall conform to the manufacturer's written installation instructions for the materials being utilized. All underground utilities shall be installed to the depths indicated below, unless otherwise submitted to and approved by the Contracting Officer.

Type of Utility	Minimum Depth of Burial
Storm Sewer	12 Inches
Electrical - Fused	24 Inches
Electrical - Nonfused	36 Inches
Electrical - 600V to 35KV	42 Inches

3.20 PLASTIC WARNING TAPE: Plastic warning tape shall be installed with all underground utilities. Plastic warning tapes shall be installed directly above all pipe and cable, at a depth of 12 inches below finished grade unless otherwise indicated. Tape shall bear a continuous printed inscription describing the specific utility.

3.21 GRADING: Areas disturbed during construction shall be reconstructed 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.

3.22 SPREADING TOPSOIL: Areas from which topsoil has been removed shall be retopsoiled. The surface shall be free of materials that would hinder planting or maintenance operations. The subgrade shall be pulverized to a depth of 2 inches 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 and slopes shown, and left free of surface irregularities. Topsoil shall be compacted by one pass of a cultipacker, roller, or other approved equipment. 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.

3.23 REESTABLISHMENT OF TURF: Reestablish turf on the work site after construction has been completed. New turf shall be established as specified in SECTION 02930, SEEDING AND FERTILIZING.

3.24 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 slope.

DIVISION 2 - SITEWORK

SECTION 02510

ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for asphaltic concrete paving required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Publications are assumed to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Association of State Highway and Transportation Officials (AASHTO) Publication:

T 102	Spot Test of Asphaltic Materials.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

C29	Unit Weight and Voids in Aggregate.
C88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
C117	Materials Finer Than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.
C127	Specific Gravity and Absorption of Coarse Aggregate.
C128	Specific Gravity and Absorption of Fine Aggregate.
C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
C136	Sieve Analysis of Fine and Coarse Aggregates.
C183	Sampling and Acceptance of Hydraulic Cement.
D5	Penetration of Bituminous Materials.
D75	Sampling Aggregates.
D140	Sampling Bituminous Materials.
D242	Mineral Filler for Bituminous Paving Mixtures.
D946	Penetration-Graded Asphalt Cement for Use in Pavement Construction.
D977	Emulsified Asphalt.
D1856	Recovery of Asphalt from Solution by Abson Method.
D2027	Cutback Asphalt (Medium-Curing Type).

D2172	Quantitative Extraction of Bitumen from Bituminous Paving Mixtures.
D2216	Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.
D3381	Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
D3515	Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

1.2.3 Military Standard (MStd):

620	Test Methods for Bituminous Paving Materials.

1.2.4 State of Kansas Department of Transportation (KDOT) Publication: All references to "The State" or "The Engineer" shall be considered as referring to "The Contracting Officer".

Standard Specifications for State Road and Bridge Construction.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Batch Tickets: The Contractor shall submit asphaltic concrete paving material supplier's batch tickets showing the weight, type mix and temperature of each batch of asphaltic concrete paving material delivered to the site.

1.3.3 Job-Mix Formula: The Contractor shall submit his proposed job-mix formula and supporting test data.

1.3.4 Test Results: The Contractor shall submit test results for aggregate gradation, aggregate moisture content, aggregate soundness and wear, asphalt content, laboratory density, and field densities. Supplier's certifications may be in lieu of test results for aggregate gradation, aggregate moisture content, aggregate soundness and wear, and asphalt content.

1.3.5 Application for DA Radiation Authorization or Permit: The Contractor shall submit DA Form 3337, Application for Department of the Army Radiation Authorization or Permit, 60 days prior to use of nuclear density testing equipment.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ASPHALT CEMENT: Asphalt cement shall conform to ASTM D946, Penetration Grade and Type AC-5 or ASTM D3381, Viscosity Grade and Type VAC-5. Asphalt cement shall also show a negative spot when subjected to the spot test specified in AASHTO T102, using standard naphtha.

2.3 BASE COURSE AGGREGATE: Aggregate for base course construction shall conform to KDOT Standard Specifications for State Road and Bridge Construction requirements for Type AB-3 aggregate.

2.4 BITUMINOUS PAVING AGGREGATES: Aggregate for asphaltic concrete paving mix shall consist of clean, sound, durable, crushed stone, crushed slag, crushed gravel, screenings, natural or manufactured sands, and mineral filler. Coarse aggregate is material retained on the No. 4 sieve; fine aggregate is material passing the No. 4 sieve and retained on the No. 200 sieve; and filler material is material passing the No. 200 sieve. Aggregate sampling shall conform to ASTM D75 for aggregates and ASTM C183 for mineral filler. Sieve analysis of aggregates shall conform to ASTM C136 for aggregates and ASTM C117 for mineral filler. Moisture content of aggregate shall not exceed 0.70 percent as determined in accordance with ASTM D2216. Unit weight and voids in aggregate shall be determined in accordance with ASTM C29. Absorption of aggregate shall not exceed 4.0 percent as determined in accordance with ASTM C127 and ASTM C128. Aggregates shall conform to the requirements in KDOT Standard Specifications for State Road and Bridge Construction and the following:

2.4.1 Coarse Aggregate: Percentage of wear for coarse aggregate shall not exceed 40 percent after 500 revolutions, as determined in accordance with ASTM C131 and percentage of loss shall not exceed 0.90 after 5 cycles as determined in accordance with ASTM C88, using magnesium sulfate.

2.4.2 Fine Aggregates: Fine aggregates shall conform to ASTM D3515.

2.4.3 Mineral Filler: Mineral filler shall conform to ASTM D242.

2.5 BITUMINOUS PAVING MIX: Job-mix formula and asphaltic concrete paving mix for base, intermediate and surface courses shall conform to ASTM D3515 and KDOT Standard Specifications for State Road and Bridge Construction requirements for Type BM-2 asphaltic concrete paving mix. Sampling of asphaltic concrete paving mix shall conform to ASTM D140. Asphalt content shall be determined in accordance with ASTM D1856 or ASTM D2172. Penetration of recovered asphalt binder shall not be less than 60 percent of the original penetration as determined in accordance with ASTM D5. Laboratory and field densities shall be determined in accordance with MStd 620. Laboratory density shall be obtained from four sets of laboratory samples. One sample shall be obtained from each of the four sublots and be divided into three specimens to produce one set of laboratory samples for testing.

2.6 BITUMINOUS PRIME COAT: Bituminous prime coat shall be cutback asphalt, medium-curing type, conforming to ASTM D2027, Grade MC-70.

2.7 BITUMINOUS TACK COAT: Bituminous tack coat shall be emulsified asphalt conforming to ASTM D977, Grade SS-1h.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install asphaltic concrete paving as indicated on the plans and specified herein. The overall installation of asphaltic concrete paving shall conform to KDOT Standard Specifications for State Road and Bridge Construction and the requirements herein.

3.2 WEATHER LIMITATIONS: Bituminous paving operations shall not be conducted during inclement weather, when the atmospheric temperature is less than 50 degrees F, or when the surface temperature of existing pavement or base course is below 40 degrees F.

3.3 PREPARATION OF SURFACES: Immediately before applying prime or tack coats, remove all loose material, dirt, clay, or other objectional material from the surface with a power broom or blower, supplemented with hand brooms.

3.4 BITUMINOUS PRIME COAT: For new paving, apply a bituminous prime coat prior to application of the intermediate or surface course. Apply the prime coat in the quantity of 0.15 to 0.40 gallons per square yard of surface area by means of a bituminous distributor at a pressure of 25 to 75 psi. Prime coat shall be applied at between 120 and 190 degrees F.

3.5 BITUMINOUS TACK COAT: For overlay paving, apply a bituminous tack coat prior to application of the surface course. Apply the tack coat in the quantity of 0.05 to 0.15 gallons per square yard of surface area by means of a bituminous distributor at a pressure of 25 to 75 psi. Tack coat shall be applied at between 75 and 135 degrees F.

3.6 INTERMEDIATE OR SURFACE COURSE: After applying the prime coat or tack coat, whichever is appropriate, place the specified bituminous intermediate, and/or surface courses as indicated on the plans. Intermediate and/or surface courses shall be placed in accordance with KDOT Standard Specifications for Road and Bridge Construction. Temperature of asphaltic concrete paving mixture shall be not less than 225 degrees F as it is loaded into the paving machine. Lift thickness shall not exceed 4 inches for base or intermediate courses and 2 inches for surface courses.

3.7 COMPACTION: Average mat density and average joint density shall be expressed as a percentage of laboratory density. After initial rolling and preliminary smoothness tests, continue rolling with steel-wheel rollers and pneumatic-tired rollers, until average mat density is obtained in each course of not less than 98.0 percent or more than 100.0 percent of laboratory density. Average joint density shall be not less than 96.5 percent or more than 100.0 percent of laboratory density. Average mat and joint densities shall be the average density of three core samples. Compact areas inaccessible to the rollers, with hand tampers, plate vibrators, or other suitable equipment.

3.8 THICKNESS, GRADE AND SURFACE SMOOTHNESS REQUIREMENTS: Thickness, grade and surface smoothness shall be within the tolerances indicated below.

3.8.1 Thickness: Pavement thickness shall not be less than the thickness indicated on the plans.

3.8.2 Finished Grade: Finished grade of pavement shall not deviate more than 0.50 inch from the elevation indicated on the plans, or as established and approved at the work site. Finished grade at juncture with other pavement shall coincide with finished grade of abutting pavement.

3.8.3 Surface Smoothness: Finished surfaces shall not deviate more than 0.25 inch from the testing edge of a 12 foot straight edge.

3.9 JOINTS: The same texture, density, and smoothness is to be provided at joints as other sections of course. Clean or cut back contact surfaces of previously constructed pavements that have become coated with dust, sand, or other objectionable material. Spray the surface against which new material is placed with a thin, uniform coat of bituminous tack coat. At transverse joints, the edge of the previously placed course shall be cut back to expose an even, vertical surface for the full thickness of the course.

3.10 PAVEMENT EDGES: Trim pavement edges adjacent to shoulders neatly to line.

3.11 TESTING: Testing shall be performed by an approved commercial testing laboratory at the expense of the Contractor in accordance with the previously specified ASTM Publications. Test results shall be submitted to the Contract-

ing Officer. When test results indicate that materials or installation do not conform to the requirements herein, the material shall be removed, replaced and retested at no expense to the Government. The Government reserves the right to perform its own tests to verify conformance to Contract requirements. Nuclear density testing equipment shall not be operated without obtaining a Radiation Permit from the Fort Riley Radiation Protection Officer.

DIVISION 2 - SITEWORK

SECTION 02520

PORTLAND CEMENT CONCRETE PAVING, SIDEWALKS, CURBS, AND GUTTERS

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of Portland cement concrete paving, sidewalks, curbs, and gutters required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Concrete Institute (ACI) Standards:

301	Specifications for Structural Concrete for Buildings.
304R	Measuring, Mixing, Transporting, and Placing Concrete.
305R	Hot Weather Concreting.
306R	Cold Weather Concreting.
308	Curing Concrete.
309R	Consolidation of Concrete.
318/318R	Building Code Requirements for Reinforced Concrete.
347	Concrete Formwork.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

A185	Welded Steel Wire Fabric for Concrete Reinforcement.
A615/A615M	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
C94	Ready-Mixed Concrete.
C143	Slump of Portland Cement Concrete.
C231	Air Content of Freshly Mixed Concrete.
C260	Air-Entraining Admixtures for Concrete.
C494	Chemical Admixtures for Concrete.

1.2.3 State of Kansas Department of Transportation Publication: All references to "The State" or "The Engineer" shall be considered as referring to "The Contracting Officer".

Standard Specifications for State Road and Bridge Construction.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Batch Tickets: The Contractor shall submit Concrete Supplier's batch tickets showing the amounts of cement, sand, aggregate, water, and admixtures for each batch of concrete delivered to the site.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ADMIXTURES: Concrete exposed to freeze-thaw-cycles shall contain from 5 to 7 percent entrained air base as determined by ASTM C231. Water reducing or set retarding admixtures may be used when approved, provided the Portland Cement content is not left reduced. Admixtures shall conform to ASTM C260 and C494.

2.3 FILL MATERIALS: Unless otherwise specified on the plans, fill materials shall be clean, coarse sand.

2.4 JOINT MATERIALS: Joint materials shall be the type and size indicated on the plans.

2.5 READY-MIXED CONCRETE: Ready-mixed concrete shall conform to ASTM C94, and have a compressive strength of 3,000 psi and flexural strength of 600 psi at 28 days. Concrete mixes shall be proportioned in conformance with ACI 304. Slump shall be determined in accordance with ASTM C143, and shall be within the limits listed below.

Structural Element	Slump Minimum	Slump Maximum
Paving, Sidewalks, Curbs, and Gutters	1 inch	3 inches

2.6 STEEL REINFORCING BARS: Steel reinforcing bars shall conform to ASTM A615, and be Grade 60, deformed type and the size indicated on the plans.

2.7 WELDED WIRE MESH: Welded wire mesh shall conform to ASTM A185, and be flat sheets and the size and gauge indicated on the plans.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install Portland cement concrete paving, sidewalks, curbs, and gutters as indicated on the plans and specified herein. Concrete paving and sidewalk construction shall conform to the paving and sidewalk sections indicated on the plans. Concrete curbing shall match the existing curb and gutter profiles indicated on the plans. The overall installation of concrete paving, sidewalks, curbs, and gutters shall conform to KDOT Standard Specifications for State Road and Bridge Construction and the requirements herein.

3.2 FORM WORK: Form work shall be designed, constructed, and set so as to insure that the finished concrete will conform accurately to the dimensions, lines, and elevations indicated on the plans. Form work shall conform to ACI 347.

3.3 REINFORCEMENT: Reinforcing bars and welded wire mesh shall be placed as indicated on the plans. Reinforcement placement shall conform to ACI 318.

3.4 JOINTS: Joints shall be fabricated and located as indicated on the plans. Joint fabrication and installation shall conform to ACI 304.

3.5 MIXING, TRANSPORTING AND PLACING CONCRETE: Mixing, transporting and placing concrete shall conform to ACI 304. Consolidating concrete shall conform to ACI 309.

3.6 HOT WEATHER REQUIREMENTS: Hot weather concreting shall conform to ACI 305R.

3.7 COLD WEATHER REQUIREMENTS: Cold weather concreting shall conform to ACI 306R.

3.8 FINISHING OF CONCRETE: Finishing of concrete shall conform to ACI 304. The type finish shall be as indicated on the plans.

3.9 CURING OF CONCRETE: Curing of concrete shall conform to ACI 308.

3.10 TESTING: Testing shall be done in accordance with the latest edition of ACI 301. All test results shall include the date the test was performed, specific location of the tested concrete in the structure and the name of the individual who performed the test. Test results shall be attached to the quality control report on the first day they are available.

3.10.1 Strength: Mold, cure and test three specimens for each 100 cu. yd., or fraction thereof, of each mix design of concrete place in any one day.

3.10.2 Slump: Determine slump of the concrete sample for each strength test and whenever consistency of concrete appears to vary.

3.10.3 Air Content: Determine air content of the concrete sample for each strength test.

DIVISION 2 - SITEWORK

SECTION 02930

SEEDING AND FERTILIZING

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for accomplishment of seeding and fertilizing required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publication:

D2607	Peats, Mosses, Humus, and Related Products.

1.2.2 Federal Specification (FS):

O-F-241	Fertilizers, Mixed, Commercial.

1.2.3 U.S. Army Technical Manual (TM):

5-803-13	Landscape Design and Planting.

1.2.4 U.S. Department of Agriculture (USDA) Federal Seed Act:

53 CFR 1275	Rules and Regulations.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Application Instructions: Submit manufacturer's written application instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current item which conforms to the requirements specified.

2.2 FERTILIZER: Fertilizer shall be granular, commercial grade, uniform in composition, free flowing, and bear the manufacturer's guaranteed statement of analysis. Fertilizer shall conform to FS O-F-241, Type I, Level B, and be 10-20-0.

2.3 HERBICIDES, INSECTICIDES, AND FUNGICIDES: Use of herbicides, insecticides, and fungicides shall comply with applicable Federal and State laws. Herbicides, insecticides, and fungicides shall be registered with the U.S. Environmental Protection Agency, and be the proper product for the intended application.

2.4 MULCH: Mulch shall be clean, dry straw or hay.

2.5 pH ADJUSTERS: pH adjusters shall be lime or aluminum sulfate and conform to TM 5-803-13.

2.6 SEED:

2.6.1 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 mixture percentage, purity, germination, weed seed content, and inert material. Labels shall be in conformance with USDA 53 CFR 1275 and applicable state seed laws.

2.6.2 Seed Mixtures:

2.6.2.1 Built-Up Areas: Seed mixture for built-up areas shall be as follows:

Botanical Name	Common Name	Mixture Percnet by Weight	Percent Pure Live Seed
Festuca arundinacea "Mustang"	Mustang Tall Fescue	25%	85%
Festuca arundinacea "Bonanza"	Bonanza Tall Fescue	25%	85%
Festuca arundinacea "Falcon"	Falcon Tall Fescue	25%	85%
Festuca arundinacea "Rebel"	Rebel Tall Fescue	25%	85%

2.6.2.2 Range Areas: Seed mixture for range areas shall be as follows:

Name of Seed	Weight of Seed, (Pounds Pure Live Seed Per Acre)
Indiangrass (Osage)	4.0
Sideoats Grama (El Reno)	3.0
Switchgrass (Kanlow)	3.0
Big Bluestem (Kaw)	2.0
Little Bluestem (Blaze)	1.0
Total	13.0

2.6.3 Weed Seed: Weed seed shall not exceed 1 percent by weight of the total mixture. Wet, moldy, or otherwise damaged seed will be rejected.

2.8 SOIL CONDITIONERS AND AMENDMENTS: Soil conditioners and amendments shall be peats, mosses, humus, gypsum, rotted manure or sawdust, sand, or vermiculite, and conform to the requirements in TM 5-803-13. Peats, mosses, humus, and related products shall conform to ASTM D2607.

2.9 SOIL FUMIGANT: Soil fumigant shall be 97 percent methyl bromide and 3 percent chloropicrin.

2.10 TOPSOIL:

2.10.1 Topsoil: Topsoil shall be the existing surface soil stripped to a suitable depth and stockpiled on the site.

2.10.2 Additional Topsoil: Additional topsoil, if required, shall be a natural, friable soil representative of productive soils in the vicinity. It may be obtained from on-post borrow areas provided by the Contracting Officer.

PART 3 EXECUTION

3.1 GENERAL: Reestablish turf as indicated on the plans and damaged or removed to install new utilities. Establish new turf to the extent that it presents a healthy strand of grass, essentially free from weeds, voids, erosion, and disease.

3.2 PREPARATION OF SEED BEDS:

3.2.1 Tillage: Seed beds shall be tilled in accordance with the recommendations in TM 5-803-13.

3.2.2 pH Adjusters: pH adjusters shall be added to topsoil as necessary to produce topsoil suitable for growth of new turf. Application of pH adjusters shall conform to TM 5-803-13.

3.2.3 Soil Conditioners and Amendments: Soil conditioners and amendments shall be added to topsoil as necessary to produce topsoil suitable for growth of new turf. Application of soil conditioners and amendments shall conform to TM 5-803-13.

3.2.4 Soil Treatments: Should the areas to be seeded show signs of insect or noxious weed infestation, the areas shall be treated with soil fumigant, herbicide, insecticide, or fungicide as the infestation dictates. Application of soil fumigants, herbicides, insecticides, and fungicides shall conform to the manufacturer's written application instructions and TM 5-803-13.

3.2.5 Fertilizing: Fertilizer shall be applied with all seed. Fertilizer shall be applied at the rate and by the method recommended by the fertilizer manufacturer and TM 5-803-13.

3.3 SEEDING: Seed shall be applied at the rate and by the method recommended by the seed manufacturer and TM 5-803-13. After seeding, seed shall be raked-in and soil rolled as recommended by the manufacturer and TM 5-803-13.

3.4 MULCHING: All areas seeded shall be mulched. Only areas subject to erosion will require the application of asphalt adhesive to stabilize the mulch. Mulch and asphalt adhesive shall be applied at the rate and by the method recommended by the asphalt adhesive manufacturer and TM 5-803-13.

3.5 WATERING: Begin watering immediately after seeding and mulching. Water in accordance with TM 5-803-13. Water seeded areas until all seeds have germinated and the grass is two inches high. The Government will provide water at the nearest building sillcock or bulk water supply point.

3.6 PROTECTION OF SEEDED AREAS: Protect seeded areas by providing and erecting suitable barricades and signs. Remove barricades and signs once turf is established.

DIVISION 3 – CONCRETE

03300	Cast-in-Place Concrete
03730	Concrete Repair

DIVISION 3 - CONCRETE

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the accomplishment of concrete work required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. The publications are referred to in the text by basic designation only. Publications shall be assumed to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Concrete Institute (ACI) Standards:

301	Specifications for Structural Concrete for Buildings.
304R	Measuring, Mixing, Transporting, and Placing Concrete.
305R	Hot Weather Concreting.
306R	Cold Weather Concreting.
308	Curing Concrete.
309R	Consolidation of Concrete.
318/318R	Building Code Requirements for Reinforced Concrete.
347	Concrete Formwork.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

A185	Welded Steel Wire Fabric for Concrete Reinforcement.
A615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
C94	Ready-Mixed Concrete.
C143	Slump of Portland Cement Concrete.
C231	Air Content of Freshly Mixed Concrete.
C260	Air-Entraining Admixtures for Concrete.
C494	Chemical Admixtures for Concrete.
D4397	Polyethylene Sheeting for Construction Industrial and Agricultural Applications.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Batch Tickets: The Contractor shall submit Concrete Supplier's batch tickets showing the amounts of cement, sand, aggregate, water, and admixtures for each batch of concrete delivered to the site.

1.3.3 Certification: The Contractor shall submit certification that patterned concrete installer has been licensed and trained by the pattern tool manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ADMIXTURES: Concrete exposed to freeze-thaw-cycles shall contain from 5 to 7 percent entrained air base as determined by ASTM C231. Water reducing or set retarding admixtures may be used when approved, provided the Portland cement content is not left reduced. Admixtures shall conform to ASTM C260 and C494.

2.3 ANCHORS: Devices for anchoring items or structural members to concrete shall be the type and size indicated on the plans.

2.4 FILL MATERIALS: Unless otherwise specified on the plans, fill materials shall be clean, coarse sand.

2.5 JOINT MATERIALS: Joint materials shall be the type and size indicated on the plans.

2.6 READY-MIXED CONCRETE: Ready-mixed concrete shall conform to ASTM C94, and have a compressive strength of 4,000 psi and flexuous strength of 600 psi at 28 days. Ready-mixed concrete shall be proportioned in accordance with ACI 304. Slump shall be determined in accordance with ASTM C143, and shall be within the limits listed below.

Structural Element	Minimum Slump	Maximum Slump
Walls, Columns, and Grade Beams 10 Inches Maximum Thickness	2 Inches	4 Inches
Floors, Exterior Slabs, and Other Building Construction	1 Inch	3 Inches
Any Structural Concrete Approved for Pumping	None	6 Inches

2.7 STEEL REINFORCING BARS: Steel reinforcing bars shall conform to ASTM A615, and be Grade 60, deformed type and the size indicated on the plans.

2.8 VAPOR BARRIER: Vapor barriers shall be polyethylene sheeting, conform to ASTM D4397, and be not less than 6 mils thick.

2.9 WELDED WIRE MESH: Welded wire mesh shall conform to ASTM A185, and be the size and gauge indicated on the plans.

2.10 COLOR HARDENER: Color hardener shall be factory packaged dry combination of portland cement, graded quartz aggregate, coloring pigments and plasticizing admixture. Use color pigments that are finely ground, nonfading oxides interground with cement. Color shall be selected by the Contracting Officer

from the manufacturer's full range of colors and shall match the existing colored concrete.

2.11 RELEASE AGENT: Release agent shall be a dry shake powder to facilitate release of imprinting tools. Color of release agent shall be coordinated with the selected color hardener to achieve a match with the existing colored concrete.

2.12 IMPRINTING TOOLS: Imprinting tools shall be manufactured to match the existing stone pattern. Existing patterned concrete created with Bomanite Corp. imprinting tools.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall perform all concrete work indicated on the plans and specified herein.

3.2 FORM WORK: Form work shall be designed, constructed, and set so as to insure that the finished concrete will conform accurately to the dimensions, lines, and elevations indicated on the plans. Form work shall conform to ACI 347.

3.3 REINFORCEMENT: Reinforcing bars and welded wire mesh shall be placed as indicated on the plans. Reinforcement placement shall conform to ACI 318.

3.4 JOINTS: Construction, control, and expansion joints shall be fabricated and installed where indicated on the plans. Joint fabrication and installation shall conform to ACI 304.

3.5 ANCHORS: Anchors shall be installed in the locations and numbers indicated on the plans.

3.6 MIXING, TRANSPORTING AND PLACING CONCRETE: Mixing, transporting and placing concrete shall conform to ACI 304. Consolidating concrete shall conform to ACI 309.

3.7 HOT WEATHER REQUIREMENTS: Hot weather concreting shall conform to ACI 305R.

3.8 COLD WEATHER REQUIREMENTS: Cold weather concreting shall conform to ACI 306R.

3.9 FINISHING OF CONCRETE: Finishing of concrete shall conform to ACI 304. The type finish shall be as indicated on the plans.

3.9.1 Patterned Concrete: Patterned concrete shall be finished to match the existing color and configuration.

3.9.1.1: Installer shall be licensed and trained by the imprinting tool manufacturer to perform the work indicated.

3.9.1.2: Place concrete, screed to proper grade and wood float from two directions to create a uniform and open surface. Do not use metal floats.

3.9.1.3: Apply color hardener at a rate of 60 pounds per 100 square feet. Apply evenly in two passes using the dry-shake method and wood float after each shake.

3.9.1.4: Trowel surface with a steel or aluminum trowel leaving no trowel marks.

3.9.1.5: Apply release agent in an even thin coat.

3.9.1.6: While concrete is still in the plastic stage of set, apply imprinting tools to make the required patterned surface. Comply with manufacturer's instructions. Layout pattern to proper alignment and imprint to a consistent depth while concrete is plastic. Hand-tool the pattern where imprinting tools are not practical.

3.9.1.7: Provide control joints as indicated on the plans. Control joints may be tooled, cut to 1/4 thickness of the slab or construction joints.

3.9.1.8: Protect patterned concrete from premature drying, excessive hot or cold temperatures and damage.

3.10 CURING OF CONCRETE: Curing of concrete shall conform to ACI 308.

3.11 TESTING: Testing shall be done in accordance with the latest edition of ACI 301. All test results shall include the date the test was performed, specific location of the tested concrete in the structure and the name of the individual who performed the test. Test results shall be attached to the quality control report on the first day they are available.

3.11.1 Strength: Mold, cure and test three specimens for each 100 cu. yd., or fraction thereof, of each mix design of concrete placed in any one day.

3.11.2 Slump: Determine slump of the concrete sample for each strength test and whenever consistency of concrete appears to vary.

3.11.3 Air Content: Determine air content of the concrete sample for each strength test.

DIVISION 3 - CONCRETE

SECTION 03730

CONCRETE REPAIR

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the repair of concrete components required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Publications shall be assumed to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Concrete Institute (ACI) Standards:

503.3 Producing a Skid-Resistant Surface on Concrete by the Use of a Multi-Component Epoxy System.

503.4 Repairing Concrete with Epoxy Mortars.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

C109 Comperssive Strength.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 POLYMER-MODIFIED CONCRETE MORTAR: Polymer-modified concrete mortar shall have a 28-day compressive strength of 4,800 psi minimum (ASTM C 109 Modified). The material shall not contain asbestos, chlorides, nitrates, added gypsum, added lime, or high aluminum cements. Subject to compliance with requirements, provide one of the following: SikaTop 123, Sika Corporation; Masterpatch 230 VP, Master Builders, Inc.; Seal-Tight Meadow-crete, WR Meadows, Inc.; Thorite Modified with Acryl 60, Thoro System Products.

2.3 EPOXY MORTAR TOPPING: Epoxy mortar topping materials shall conform to ASTM C881. Product shall be "Permatop" as manufactured by Permagile Corp. of Plainview, NY, or "Silikal" manufactured by Silikal, Inc. of Bridgeport, CT, or approved equals. Polymer concrete overlays and epoxy mortar toppings shall match existing concrete color and be applied with non-skid finish surfaces.

2.4 BONDING AGENT: Bonding agents for patching concrete shall be similar to "Daraweld-C" or "Larson Weld-Crete", or approved equal.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall repair existing concrete components as indicated on the plans and specified herein. Spalling shall be repaired by using polymer-modified concrete mortar.

3.2 REPAIRS OF CORNER AND EDGE SPALLS: Prior to application of Portland Cement Concrete patches, existing concrete surfaces shall have all loose, deteriorated concrete removed by mechanical or manual means. Concrete surfaces shall be dry and cleaned of oils, grease, paint, and other contaminants. Edges of concrete to receive patch shall be saw cut to produce vertical edges at least 1 inch deep around the perimeter of the patch area. Approved bonding agent shall be applied to the cleaned surface immediately prior to application of the concrete patch. Use of bonding agent shall be in conformance with the manufacturer's instructions for the particular application. Concrete patch shall be placed inside formwork as required.

3.3 APPLICATION OF POLYMER-MODIFIED CONCRETE MORTAR:

3.3.1 Preparation: Prior to application of epoxy mortar toppings, all concrete to be overlaid shall be cleaned by sandblasting to remove all foreign matter, grease, oil, wax, organic coatings, dirt and efflorescence. Follow sandblasting with compressed air cleaning to remove all residue. Fill in all voids, cracks and depressions in excess of 1/2 inch depth to surfacing.

3.3.2 Application: Place epoxy mortar topping in conformance with ACI Standards 503.3 and 503.4. Overlays shall be placed to a minimum depth of 3/16 inch. Final finish shall be made to match existing adjacent surfaces. Feather-edge to 1/16 inch thickness.

DIVISION 4 – MASONRY

04200 Masonry
04400 Stone Work

DIVISION 4 - MASONRY

SECTION 04200

MASONRY

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the accomplishment of masonry work required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Concrete Institute (ACI) Standards:

318/318R	Building Code Requirements for Reinforced Concrete.
531	Building Code Requirements for Concrete Masonry Structures.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

A82	Cold-Drawn Steel Wire for Concrete Reinforcement.
A615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
C55	Concrete Building Brick.
C62	Building Brick (Solid Masonry Units made from Clay or Shale).
C90	Hollow Load-Bearing Concrete Masonry Units.
C94	Ready-Mixed Concrete.
C144	Aggregate for Masonry.
C145	Solid Load-Bearing Concrete Masonry Units.
C216	Facing Brick (Solid Masonry Units made from Clay or Shale).
C270	Mortar for Unit Masonry.
C404	Aggregate for Masonry Grout.
C476	Grout for Reinforced Masonry.
C652	Hollow Brick (Hollow Masonry Units made from Clay or Shale).
C744	Prefaced Concrete and Calcium Silicate Masonry Units.

1.2.3 Brick Institute of American (BIA) Publications:

1A	Cold Weather Masonry Construction - Construction and Protection Recommendations.
17	Reinforced Brick Masonry - Part 1.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: Submit color samples for selection of colors.

1.3.3 Batch Tickets: Submit Concrete Supplier's batch tickets showing the amounts of cement, sand, aggregate, water, and admixtures for each batch of concrete delivered to the site.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 AGGREGATE: Aggregate for mortar shall conform to ASTM C144 and C404.

2.3 ANCHORS: Devices for anchoring items or structural members to masonry shall be the type and size indicated on the plans.

2.4 CONCRETE MASONRY UNITS: Hollow load-bearing concrete masonry units shall conform to ASTM C90, Grade N, Type I for exterior walls and Grade S, Type I for interior walls. Ceramic glazed concrete masonry units shall conform to ASTM C126, C744, and C90 and C145, Grade S, Type I. Solid load-bearing concrete masonry units shall conform to ASTM C145, Grade N, Type I for exterior walls and Grade S, Type I for interior walls. Concrete masonry units shall be normal weight, and the type and size indicated on the plans. Color of ceramic glazed concrete masonry units shall be selected by the Contracting Officer from samples provided by the Contractor.

2.5 EXPANSION JOINT MATERIALS: Expansion joint materials shall be the type and size indicated on the plans.

2.6 JOINT REINFORCEMENT: Joint reinforcement shall be factory-fabricated from 8 gauge welded galvanized steel wire conforming to ASTM A82. Joint reinforcement and wall ties may be separate items or combination joint reinforcement and wall ties. Joint reinforcement shall be ladder or truss type and have a width 2 inches less than the wall thickness in which it is being installed. Corners and tees shall be factory or field-fabricated.

2.7 MORTAR AND GROUT: Mortar for unit masonry shall conform to ASTM C270, Type S. Grout for masonry shall conform to ASTM C476.

2.8 READY-MIXED CONCRETE: Ready-mixed concrete shall conform to ASTM C94, and have a compressive strength of 4,000 psi and flexural strength of 600 psi at 28 days.

2.9 STEEL REINFORCING BARS: Steel reinforcing bars shall conform to ASTM A615, and be Grade 60, deformed type and the size indicated on the plans.

2.10 STONE ITEMS: Stone items shall be of the type, material, and size indicated on the plans.

2.11 WALL TIES: Wall ties shall be factory-fabricated from galvanized or copper-clad steel, and the type and size indicated on the plans.

PART 3 EXECUTION

3.1 GENERAL: Perform all masonry work indicated on the plans and specified herein.

3.2 ERECTION: Erection of masonry shall conform to the applicable portions of ACI 531 and BIA 17.

3.3 ANCHORS: Anchors shall be installed in the locations and numbers indicated on the plans.

3.4 JOINTS: Control and expansion joints shall be fabricated and installed where indicated on the plans.

3.5 REINFORCEMENT:

3.5.1 Reinforcement Bars: Reinforcement bars shall be placed as indicated on the plans. Reinforcement placement shall conform to ACI 318.

3.5.2 Joint Reinforcement and Wall Ties: Joint reinforcement shall be installed 1 foot 4 inches on center vertically, and 8 inches on center vertically 2 courses above and below openings and in parapet walls. Wall ties shall be installed 2 feet on center horizontally and 1 foot 4 inches on center vertically so that there is not less than 1 wall tie per 3 square feet of wall area.

3.6 COLD WEATHER REQUIREMENTS: Cold-weather masonry work shall conform to BIA 1A.

DIVISION 4 - MASONRY

SECTION 04400

STONEWORK

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the accomplishment of stonework required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

C270 Mortar for Unit Masonry.

C568 Specification for Limestone Building Stone.

1.2.2 Indiana Limestone Institute of America (ILI) Publication:

Indiana Limestone Institute Handbook.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Shop Drawings: Submit cutting and setting drawings indicating sizes, locations, dimensions, engraving, sections and profiles of stones; and details showing relationship with, attachment to, and reception of related work.

1.3.3 Samples: Submit stone samples (minimum size: 4 by 4-inches) for each color, grade, finish, type and variety of stone required. Submit two samples of each showing the full range of variations to be expected in completed work.

1.3.4 Batch Tickets: Submit concrete supplier's batch tickets showing the amounts of cement, sand, aggregate, water, and admixtures for each batch of concrete delivered to the site.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ANCHORS: Cramps, pins, ledge angles and other devices for anchorage and alignment of stone items to masonry shall be type 304 stainless steel of the type, design and size indicated on the plans and necessary to perform the intended function.

2.3 JOINT SEALANT: One-part non-sag moisture curing type I polyurethane matching color of limestone. Where designated, install over sealant manufacturer recommended foam rod or bond breaker.

2.4 MORTAR: Mortar for unit masonry shall conform to ASTM C270, Type S. Do not use calcium chloride or admixtures including air-entraining agents, accelerators, retarders, water repellant agents, anti-freeze compounds, or other agents unless otherwise indicated.

2.5 STONE:

2.5.1 General:

2.5.1.1 Obtain each type, color, grade, finish and variety of stone from a single quarry with resources to furnish materials of consistant quality in appearance and physical characteristics, including capacity to cut and finish the stone without delaying progress of the work.

2.5.1.2 Finished stone shall be carefully factory packed and shipped in a manner to prevent chipping, cracking, staining, and other damage. Damaged stone units will not be accepted. Store units off the ground adequately braced and protected from damage and elements until ready for use.

2.5.3 Limestone: Limestone veneer shall conform to ASTM C568 and meet standards of the Indiana Limestone Institute Handbook. Ashlar veneer units shall match existing stone veneer in appearance, finish and color. Ashlar cut stone panels shall be smooth-cut “Top Ledge Cottonwood” stone.

2.5.3.1 Contractor may salvage and reuse existing demolished, undamaged limestone. Salvaged limestone shall have existing mortar removed. Exposed surfaces shall be cleaned as required to blend with surrounding new or existing stone.

2.6 TIES: Veneer ties shall be factory-fabricated from type 304 stainless steel, and the type, design and size indicated on the plans.

PART 3 EXECUTION

3.1 GENERAL: Perform stonework as indicated on the plans and specified herein.

3.2 ERECTION: Erect stone masonry in accordance with the applicable portions of the Indiana Limestone Institute Handbook and NBGQA Specifications for Architectural Granite. Joints in stone masonry shall be 3/8 inch unless otherwise noted. Wet dry stone units immediately prior to installation. Do not set heavy stones until mortar in lower courses has hardened sufficiently to resist being squeezed out of joint.

3.3 ANCHORS: Install anchors in the locations and numbers indicated on the plans.

3.4 CLEANING: Clean stonework within 6 days of completion using clean water and stiff bristle brushes. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh componants or other materials or methods which could cause damage to stonework. Protect stonework from damage and staining by approved methods until substantial completion.

DIVISION 5 – METALS

05060	Welding, Structural
05120	Structural Steel
05500	Metal Fabrications
05501	Anchor Bolts
05510	Metal Stairs

DIVISION 5 - METALS

SECTION 05060

WELDING, STRUCTURAL

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for structural welding required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Publications shall be assumed to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Institute of Steel Construction (AISC) Publication:

Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

1.2.2 American National Standards Institute (ANSI) Standard:

Z49.1 Safety in Welding and Cutting.

1.2.3 American Society for Nondestructive Testing (ASNT) Publication:

SNT-TC-1A Personnel Qualification and Certification in Nondestructive Testing.

1.2.4 American Welding Society (AWS) Publications:

A2.4 Symbols for Welding and Nondestructive Testing.

A3.0 Welding Terms and Definitions.

D1.1 Structural Welding Code - Steel.

1.3 SUBMITTALS:

1.3.1 Welding Procedure Specifications: The Contractor shall submit welding procedure specifications.

1.3.2 Procedure Qualification Test Records: The Contractor shall submit procedure qualification test records.

1.3.3 Welder and Tacker Qualification Test Records: The Contractor shall submit welder and tacker qualification test records.

1.4 GENERAL REQUIREMENTS: The design of welded connections shall conform to the AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings 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, 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, and tacker performance qualifications.

1.4.1 Definitions: Definitions of welding terms shall be in accordance with AWS A3.0.

1.4.2 Symbols: Symbols shall be in accordance with AWS A2.4, unless otherwise indicated.

1.4.3 Safety: Safety precautions during welding shall conform to ANSI Z49.1.

1.5 WELDING PROCEDURE QUALIFICATION: 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. The number of copies shall meet the requirements for shop drawings in SECTION 01300, SUBMITTALS. 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 shop 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:

1.5.1.1 Copies of the welding procedure specifications, the procedure qualification test records, and the welder or tacker qualification test records are submitted and approved in accordance with the requirements for shop drawings in SECTION 01300, SUBMITTALS.

1.5.1.2 Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

1.5.1.3 The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

1.5.1.4 The welder 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 AND TACKER QUALIFICATION: Each welder 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 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 and tackers previously qualified by test within the previous 6 months may be accepted for this contract without requalification if all the following conditions are met:

1.6.1.1 Copies of the welding procedure specifications, the procedure qualification test records, and the welder and tacker qualification test records are submitted and approved in accordance with the requirements for shop drawings in SECTION 01300, SUBMITTALS.

1.6.1.2 Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

1.6.1.3 The previously qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

1.6.1.4 The welder 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 or tacker to work under this contract, the Contractor shall submit the names of the welders 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 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:

1.6.3.1 Requalification of a welder shall be required under any of the following conditions:

1.6.3.1.1 It has been more than 6 months since the welder has used the specific welding process for which he/she is qualified.

1.6.3.1.2 There is specific reason to question the welder's ability to make welds that meet the requirements of these specifications.

1.6.3.1.3 The welder 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 was last employed, and the process for which qualified shall be submitted as evidence of conformance.

1.6.3.2 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/she 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 QUALIFICATION OF INSPECTION AND NONDESTRUCTIVE TESTING PERSONNEL: Inspection and nondestructive testing personnel shall be qualified in accordance with the requirements of ASNT SNT-TC-1A 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 SNT-TC-1A, and assistant inspectors may perform specific inspection functions under the supervision of the qualified inspector.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 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 performing qualified welding procedures. All welding equipment and materials shall comply with the applicable requirements of AWS D1.1.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall perform structural welding as indicated on the plans and specified herein.

3.2 WELDING OPERATIONS:

3.2.1 Requirements: Workmanship and techniques for welded construction shall conform to the requirements of AWS D1.1 and AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings. When AWS D1.1 and the AISC specification conflict, the requirements of AWS D1.1 shall govern.

3.2.2 Identification: Welds shall be identified in one of the following ways:

3.2.2.1 Written records shall be submitted to indicate the location of welds made by each welder or tacker.

3.2.2.2 Each welder or tacker shall be assigned a number, letter, or symbol to identify welds made by that individual. The Contracting Officer may require welders 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 3-foot intervals. Identification with die stamps or electric etchers shall not be allowed.

3.3 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 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.

3.4 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.

3.5 GOVERNMENT INSPECTION AND TESTING: In addition to the inspection and tests performed by the Contractor for quality control, the Government reserves the right to perform supplemental nondestructive and destructive tests to determine compliance with Paragraph STANDARDS OF ACCEPTANCE.

3.5.1 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.

3.5.2 Destructive Tests: When metallographic specimens are removed from any part of a structure, the Contractor shall make repairs. The Contractor shall employ qualified welders, and shall use the proper joints and welding procedures, including peening or heat treatment if required, to develop the full strength of the members and joints cut and to relieve residual stress.

3.6 CORRECTIONS AND REPAIRS: When inspection or testing indicates defects in the weld joints, the welds shall be repaired using a qualified welder 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.

DIVISION 5 - METALS

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of structural steel, open web steel joists, and steel roof decking required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Institute of Steel Construction (AISC) Publications:

S302	Code of Standard Practice for Steel Buildings and Bridges.
S326	Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.
S329	Structural Joints Using ASTM A325 and A490 Bolts.

1.2.2 American Iron and Steel Institute (AISI) Publication:

SG-673 Parts I - VII	Specification for the Design of Cold-Formed Steel Structural Members.

1.2.3 American Society for Testing and Materials (ASTM) Publications:

A36/A36M	Structural Steel.
A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
A325	High-Strength Bolts for Structural Steel Joints.
A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
A501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
A525	General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

1.2.4 American Welding Society (AWS) Publication:

D1.1	Structural Welding Code, Steel.

1.2.5 Steel Deck Institute (SDI) Publication:

Design Manual for Floor Decks and Roof Decks.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.3 Shop Drawings: Submit shop drawings of the proposed fabrication, installation, connection, and accessories for structural steel, open web steel joists, and steel roof decking.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 BOLTS: Bolts shall conform to ASTM A325 or A490, and be the type and size indicated on the plans.

2.3 STEEL BAR JOISTS: Steel bar joists and accessories shall conform to AISC S326, and be the type and size indicated on the plans.

2.4 STEEL DECKING: Steel decking and accessories shall conform to AISI SG-673, "SDI Publication: "Design Manual for Floor Decks and Roof Decks", and be fabricated from galvanized steel conforming to ASTM A525. Steel decking shall be the type and size indicated on the plans.

2.5 STEEL PIPE: Steel pipe shall conform to ASTM A53, Type S, Grade A, Standard Weight, Schedule 40. Steel pipe shall be the size indicated on the plans.

2.6 STEEL SHEET AND STRIPS: Steel sheet and strips shall conform to ASTM A570/A570M, and be the type and size indicated on the plans.

2.7 STRUCTURAL STEEL: Structural steel shall conform to ASTM A36/A36M, and be the type and size indicated on the plans.

2.8 STRUCTURAL STEEL TUBING: Structural steel tubing shall conform to ASTM A500 or A501, and be the type and size indicated on the plans.

PART 3 EXECUTION

3.1 GENERAL: Install all structural steel and steel roof decking as indicated on the plans and specified herein.

3.2 ERECTION OF STRUCTURAL STEEL: Erect structural steel in accordance with AISC S302, and S326.

3.3 INSTALLATION OF STEEL ROOF DECK: Install steel roof deck and accessories in accordance with SDI Publication: "Design Manual for Floor Decks and Roof Decks."

3.4 WELDING: Weld structural steel and steel roof decking in accordance with AWS D1.1.

3.5 PAINTING: Paint structural steel and connections in accordance with AISC S326.

DIVISION 5 - METALS

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of metal fabrications required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

A36/A36M	Structural Steel.
A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
B209	Aluminum and Aluminum-Alloy Sheet and Plate.
B210	Aluminum-Alloy Drawn Seamless Tubes.
B221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
C94	Ready-Mixed Concrete.

1.2.2 American Welding Society (AWS) Publication:

D1.1	Structural Welding Code, Steel.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.3 Shop Drawings: Submit shop drawings of the proposed installation of bollards, door lintels, handrails, and safety nosing.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ALUMINUM: Aluminum and aluminum-alloy sheet and plate shall conform to ASTM B209. Aluminum-alloy drawn seamless tubes shall conform to ASTM B210. Aluminum and aluminum-alloy extruded bars, rods, wire, shapes, and tubes shall conform to ASTM B221.

2.3 BOLLARDS: Bollards shall be fabricated as indicated on the plans from 6 inch diameter standard weight steel pipe which conforms to ASTM A53, Type S, Grade A, Standard Weight, Schedule 40. Bollards shall be filled with ready-mixed concrete which conforms to ASTM C94. Concrete shall have a compressive strength of 3,000 psi at 28 days.

2.4 DOOR LINTELS: Door lintels shall be fabricated as indicated on the plans using structural steel members which conform to ASTM A36/A36M.

2.5 HANDRAILS: Handrails shall be fabricated as indicated on the plans from steel pipe which conforms to ASTM A53, Type S, Grade A, Standard Weight, Schedule 40.

PART 3 EXECUTION

3.1 GENERAL: Install metal fabrications as indicated on the plans and specified herein.

3.2 INSTALLATION: Install metal fabrications in accordance with the fabrication manufacturer's written installation instructions and the Contractor's approved shop drawings.

3.3 WELDING: Weld structural steel in accordance with AWS D1.1.

3.4 PAINTING: Prime and paint metal fabrications immediately following fabrication.

DIVISION 5 - METALS

SECTION 05501

ANCHOR BOLTS

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of anchor bolts and expansion anchors required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Publications shall be assumed to be the most current edition in effect at the time the contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standards:

B18.22.1	Plain Washers.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

A307	Carbon Steel Externally Threaded Standard Fasteners.

1.2.3 Federal Specification (FS):

FF-S-325	Shield, Expansion; Nail Expansion; and Nail Drive Screw (Devices, Anchoring and Masonry).

1.2.4 Industrial Fasteners Institute (IFI) Publication:

104	Mechanical and Quality Requirements for Stainless Steel and Nonferrous Bolts, Screws, Studs and Nuts.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 BOLTS AND NUTS: Bolts and nuts shall be the type and size indicated on the plans. Carbon steel bolts and nuts shall conform to ASTM A307. Unless otherwise indicated, all anchor bolts shall have a diameter of at least 3/4 inch. All anchor bolts shall be carbon steel unless otherwise specified or indicated on the plans.

2.3 EXPANSION ANCHORS: Expansion anchors for concrete shall conform to FS FF-S-325, and be the type and size indicated on the plans. The wedge-type expansion anchors shall be Group II, Type 4, Class 1 or 2. The non-drilling type expansion anchors shall be Group VIII, Type 1 or 2. Expansion anchors

indicated or accepted in lieu of anchor bolts for structural framing shall have a diameter of at least 3/4 inch. All other expansion anchors shall have a diameter of at least 1/2 inch. Acceptable manufacturers include Phillips, Rawlplug, USM or Wej-It.

2.4 FLAT WASHERS: Flat washers shall conform to ANSI B18.22.1 and be of the same material as the bolts and nuts. Flat washers shall be the type and size indicated on the plans.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install anchor bolts and expansion anchors as indicated on the plans and specified herein.

3.2 ANCHOR BOLTS: Anchor bolts to be epoxy grouted shall be clean and free of coatings that would weaken the bond with epoxy. Two nuts and a washer shall be furnished for all anchor bolts.

3.3 EXPANSION ANCHORS: Expansion anchors shall be installed in accordance with the manufacturer's written installation instructions, but in no case shall the depth of the hole be less than four bolt diameters. Minimum distance between the center of any expansion anchor and an edge or exterior corner of concrete shall be at least 4 1/2 times the diameter of the hole in which the anchor is installed. Unless otherwise indicated, the minimum distance between centers of expansion anchors shall be at least 8 times the diameter of the hole in which the anchors are installed. Nuts and washers for expansion anchors shall be as specified for anchor bolts.

DIVISION 5 - METALS

SECTION 05510

METAL STAIRS

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of metal stairs required in this project.

1.**2 APPLICABLE PUBLICATIONS**: The publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Publications shall be assumed to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Institute of Steel Construction (AISC) Publication:

S326	Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

1.2.2 American National Standards Institute (ANSI) Standards:

B18.21.1	Lock Washers.
B18.22.1	Plain Washers.

1.2.3 American Society for Testing and Materials (ASTM) Publications:

A36/A36M	Structural Steel.
A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
A307	Carbon Steel Externally Threaded Standard Fasteners.
A366/A366M	Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
A501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

1.2.4 American Welding Society (AWS) Publications:

D1.1	Structural Welding Code, Steel.
D1.2	Structural Welding Code, Aluminum.

1.2.5 Federal Specification (FS):

RR-G-661	Grating, Metal, Bar Type (Floor, Except for Naval Vessels).

1.2.6 Industrial Fasteners Institute (IFI) Publications:

100	Prevailing-Torque Type Steel Hex Locknuts.

104 Mechanical and Quality Requirements for Stainless Steel and Nonferrous Bolts, Screws, Studs, and Nuts.

1.2.7 National Association of Architectural Metal Manufacturers (NAAMM) Publication:

Metal Bar Grating Manual.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

1.3.3 Shop Drawings: The Contractor shall submit shop drawings of the proposed fabrication and installation of metal stairs. All welds shall be properly identified on the detailed shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 BOLTS AND NUTS: Unfinished steel bolts and nuts shall conform to ASTM A307, and be the type and size indicated on the plans.

2.3 HANDRAIL CONNECTIONS: All angles, offsets or other changes in alignment in pipe railings shall be made with R&B Wagner railing ells and welding connectors, or approved equals. Field joints in welded railings shall be made with R&B Wagner "Doublelock Splice-Lock", at least 3 3/4 inches long, or an approved equal.

2.4 HANDRAIL-SETTING CEMENT: Handrail setting cement shall be Minwax "Super Por-Rok Cement", Master Builders "Set 45", or an approved equal.

2.5 SELF-LOCKING NUTS: Self-locking nuts shall conform to IFI 100, and be the type and size indicated on the plans.

2.6 SHOP COATINGS: Rust inhibitive primer shall be Cook "391-N-14L Clorocon Barrier Coat", Koppers "No. 10 Inhibitive Primer", Valspar "13-R-28 Chromox Primer", Tremec "37-77 Chem-Prime", or an approved equal. Coal tar paint shall be Koppers "Bitumastic Super Service Black", Valspar "High-Build Bituminous Coating 35-J-10", Tremec "46-449 Heavy Duty Black", or an approved equal.

2.7 STAINLESS STEEL BOLTS AND NUTS: Stainless steel bolts and nuts shall conform to IFI 104, and be the type and size indicated on the plans.

2.8 STEEL ANGLES, CHANNELS AND PLATES: Steel angles, channels, and plates shall conform to ASTM A36/A36M, and be the type and size indicated on the plans.

2.9 STEEL GRATING: Steel grating for stair treads and landings shall conform to FS RR-G-661, Type I, and be rectangular, welded, galvanized after fabrication. Bearing bars shall be at least 3/16 inch thick with center-to-center spacing of 1 3/16 inch. Gratings shall be the type and size indicated on the

plans. Stair treads and stairway landing shall be filled with nonslip nosings as indicated on the plans.

2.10 STEEL HANDRAIL: Steel handrails shall be constructed of 1 1/2 inch black steel pipe which conforms to ASTM A53, Type S, Grade A, Standard Weight, Schedule 40.

2.11 STEEL SHEET: Steel sheet used for pipe column bases and to connect 5 by 5 structural angles shall conform to ASTM A366/A366M, and be the type and size indicated on the plans.

2.12 STRUCTURAL TUBING: Structural tubing used for the steel pipe columns shall conform to ASTM A500 or A501, and shall be the type and size indicated on the plans.

2.13 WASHERS: Flat washers shall conform to ANSI 18.22.1. Lock washers shall conform to ANSI B18.21.1. Washers shall be the type and size indicated on the plans.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall fabricate and install the metal stair system as indicated on the plans and specified herein.

3.2 FABRICATION AND INSTALLATION: Fabrication and installation of the metal stair system shall be accomplished in accordance with any applicable manufacturer's written installation instructions, the Contractor's approved shop drawings, and the requirements herein. Structural and miscellaneous metal work shall be fabricated in conformity with dimensions, arrangement, sizes, and weights or thicknesses specified or indicated on the plans. All members and parts, as delivered and erected, shall be free of winds, warps, local deformations, and unauthorized bends. Holes and other provisions for field connections shall be accurately located and shop checked so that proper fit will result when the unit is assembled in the field. Shop drawings shall be prepared and each separate piece shall be marked as indicated herein. All field connection materials shall be furnished. Metal work shall be stored on blocking so that no metal touches the ground and water cannot collect thereon. The material shall be protected against bending under its own weight or superimposed loads. Before assembly, surfaces to be in contact with each other shall be thoroughly cleaned. All parts shall be assembled accurately as indicated on the plans. Light drifting will be permitted to draw parts together, but drifting to match unfair holes will not be permitted. Any enlargement of holes necessary to make connections in the field shall be done by reaming with twist drills. Enlarging holes by burning will not be permitted.

3.3 ERECTION OF STEEL STAIRS: Unless otherwise indicated, all materials and work shall conform to the applicable provisions of the AISC S326. Steel stairs shall be the dimensions, arrangements, and numbers indicated on the plans, and be accurately framed, strongly and rigidly connected, and smoothly finished. When erected, stairs shall be true to line and slope, rigidly supported, and be braced and tightened to prevent movement. All treads shall be level and in perfect alignment and spacing. Handrails shall be in alignment and rigidly connected. After installation, stairs shall be rigid and not noticeably sway or deflect under foot traffic. If necessary to prevent noticeable movement, additional supports, or bracing shall be provided.

3.3.1 Connections: Unless otherwise indicated, all connections shall be made with unfinished bolts. All bolts shall be equipped with self-locking nuts or unfinished nuts and lock washers. Where welding is required or permitted, all butt and miter welds shall be continuous and, where exposed to view, ground

smooth. Intermittent welds shall have an effective length of at least 2 inches and be spaced not more than 6 inches apart. Welding shall be in accordance with AWS D1.1.

3.3.2 Miscellaneous Mountings on Supports: Items that do not form a part of the structural framework of the stairs and are not specified elsewhere, such as angles, channels, bars, plates and rods, shall be provided as indicated or as required. The items shall be punched, welded, or bolted to metal, as indicated or as required. All bolts, metal and synthetic washers, clips, and similar items as required for the work shall be provided. Anchor bolts and expansion anchors are covered in SECTION 05501, ANCHOR BOLTS.

3.4 RAILINGS: Unless otherwise indicated on the plans, all railings provided under this section shall be of the same type and design. All welding shall be done in accordance with AWS D1.1 or D1.2. Welds shall be free of porosity, cracks, holes, and flux. All fasteners used in connection with aluminum railings shall be stainless steel. All railings shall be capable of at least 200 pounds applied in any direction at any point on the rail.

3.4.1 Fabrication: Railings shall be smooth, with all projecting joints and sharp corners ground smooth. Welded joints shall be flush type. Members shall be neatly coped and continuously welded or mechanically connected at all junctions. Top rails shall run continuously over posts. All rails and posts shall be in the same plane and not offset. All welding shall be done neatly and substantially by a process (ie, TIG or MIG) producing a smooth weld. All weld spatters and burrs shall be removed, and welds thoroughly brushed with a stainless steel power wire brush.

3.4.2 Erection: When railings are assembled, all posts shall be plumb and longitudinal members shall be parallel with each other and with the floor surface or slope of stairs. In any section or run of railing, the centerlines of all members shall be in true alignment lying in the same vertical plane. All posts in fixed handrail sections shall be rigidly attached to the supporting structure. The position of all handrail mounting brackets shall be carefully measured before railings are fabricated. When railings are set, the posts shall be wedged in accurate alignment and attached to the handrail mounting brackets. Aluminum handrail posts shall be attached to the handrail mounting brackets by coating the steel rods of these brackets with handrail setting cement. Steel handrail posts shall be attached to the handrail mounting brackets using bolts or by welding. Where so indicated, attachments shall be made with flanges or other special attachments or anchorages. Maximum spacing for posts shall be 5 feet. After installation, railings shall be checked for final alignment using a tightly drawn wire for reference. The maximum misalignment tolerance for railings shall be 1/8 inch in 12 feet. Bent, deformed, or otherwise damaged railings shall be replaced at the Contractor's expense.

3.5 GRATING: All grating and grating stair treads shall be aluminum or steel as specified herein. Depth of bearing bars for grating and treads shall be as indicated on the plans. Except as modified herein, grating manufacture, fabrication, and installation shall comply with recommendations in the NAAMM Metal Bar Grating Manual.

3.5.1 Fabrication: Bands shall be 3/16 inch thick. Bands shall be welded to first, last, and every fourth intermediate bar. Cross bars shall be cut off flush with the outside face of side bars. All re-entrant and other cuts in aluminum grating shall be sawed or sheared. All re-entrant and other cuts in steel grating may be made by flame cutting. All other cuts in steel grating shall be sawed or sheared. Cuts shall be clean and smooth without fins, beads, or other projections. Grating stair treads shall be provided with carrier plates and abrasive nosing. Stair treads shall be fastened to stair

stringers with galvanized bolts. The portion of the landing which is the top stair shall also be provided with an abrasive nosing.

3.5.2 Installation: Each grating panel shall be fastened in place with saddleclips or flange blocks as illustrated in NAAMM Metal Bar Grating Manual. Clips for steel grating shall be galvanized steel. Clips or flange blocks for aluminum grating shall be stainless steel. Clips shall be fastened to supporting steel with Nelson stud type bolts not less than 1/4 inch in diameter. All fastener parts shall be galvanized or corrosion resistant alloy.

3.6 PAINTING: Ferrous metal stair components shall be prepared, primed and painted in accordance with AISC S326.

DIVISION 6 – WOOD AND PLASTICS

06100 Carpentry
06200 Finish Carpentry
06410 Custom Casework

DIVISION 6 - WOOD AND PLASTIC

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for accomplishing rough carpentry required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standard:

A135.4	Basic Hardboard.

1.2.2 American Plywood Association (APA) Publication:

APA-01	Adhesives for APA Glued Floor System.

1.2.3 American Society for Testing and Materials (ASTM) Publications:

A307	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
D2559	Adhesives For Structural Laminated Wood Products For Use Under Exterior (Wet Use) Exposure Conditions.
D5055	Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.

1.2.4 American Wood Preservers Association (AWPA) Standard:

C2	Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes.

1.2.5 American Wood-Preservers' Bureau (AWPB) Standard:

LP 2	Standard for Softwood Lumber, Timbers and Plywood Pressure Treated with Water-Borne Preservatives for Above Ground Use.

1.2.6 California Redwood Association (CRA) Publication:

Standard Specifications for Grades of Redwood Lumber.

1.2.7 National Evaluation Service (NES) Reports (NER):

126	Microllam™ Laminated Veneer Lumber, SC Beams™ and Billet Beams; Stair-Step Modules and Timberstrand® LSL Stringers.
200	TJI® Joist, TJI®/96 Joist, and Big Red™ Garage Door Header.

292 Parallam® Parallel Strand Lumber (PSL).

481 Timberstrand™ Laminated Strand Lumber (LSL).

1.2.7 National Forest Products Association (NFOPA) Publications:

NFOPA-01 National Design Specification for Wood Construction.

NFOPA-02 Manual for Wood Frame Construction.

1.2.8 Southern Pine Inspection Bureau (SPIB) Publication:

Grading Rules for Southern Pine Lumber.

1.2.9 U.S. Department of Commerce Commercial Standards (CS) and Product Standards (PS):

CS 236 Mat-Formed Wood Particleboard.

PS 1 Construction and Industrial Plywood.

PS 20 American Softwood Lumber Standard.

PS 58 Basic Hardboard.

1.2.10 U.S. Department of Housing and Urban Development (HUD) Publication:

4930.1 Manual of Acceptable Practices.

1.2.11 Western Wood Products Association (WWPA) Publication:

Grading Rules for Western Lumber.

1.2.12 Wood Moulding and Millwork Producers Association (WMMPA) Publications:

WM 4 Quality Standard for Wood Moulding.

WM 6 Industry Standard for Non-Pressure Treating of Wood Millwork.

WM 7 WM/Series Wood Moulding Patterns.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major lumber and materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.3 Samples: Submit color and pattern samples for selection of colors and patterns, when applicable.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ADHESIVES AND FASTENERS: Adhesives and fasteners shall be the proper product for the intended application. Adhesives shall be waterproof. Adhesives for APA glued floor systems shall conform to APA-01. Fasteners exposed to the weather shall be aluminum alloy, cadmium, zinc-plated steel, or other noncorrosive metal.

2.2.1 Anchor Bolts: Conform to ASTM A307, size and locations as indicated of the plans, complete with hex nuts and washers.

2.2.2 Connection Bolts: Lag, toggle, and miscellaneous bolts and screws. Type, size and finish as shown on plans as best suited for intended use.

2.3 LUMBER: Lumber shall conform to PS 20, be surfaced on all four sides (S4S), and the size and type indicated on the plans. Pressure treated lumber shall conform to AWPA C2 and bear the AWPB Quality Mark LP 2. Each piece of visually graded lumber shall bear the stamp of a nationally recognized lumber grading agency indicating the grading rules under which it was produced, species and grade. Each piece of machined stress-rated lumber shall bear the stamp of a nationally recognized lumber grading agency indicating the grading rules under which it was produced, species, correlated fiber stress in bending, and modulus of elasticity. Unless otherwise indicated on the plans, lumber may be any species and grade listed in CRA Standard Specifications for Grades of Redwood lumber, SPIB Grading Rules, or WWPA Grading Rules for Western Lumber which have the minimum design value listed below. All concealed lumber in contact with concrete or masonry surfaces shall be pressure treated lumber. All exposed lumber in contact with concrete or masonry surfaces and exterior building components, latticework, Moulding, and millwork shall be construction heart redwood, cedar, or cypress.

Lumber Use Category	Minimum Fiber Stress In Bending "Fb" Single	Minimum Fiber Stress In Bending "Fb" Repetitive	Minimum Fiber Stress Elasticity "E"
Light General Framing.	675	775	900,000
Studs (Stud Grade)	525	600	900,000
Structural Beams, Joists, Rafters, and Stringers.	1,150	1,300	1,100,000
Posts and Timbers.	950	N/A	1,300,000
Miscellaneous Boards.	No. 2 Common or Better		N/A
Trim and Shelf Boards and Porch Decks.	No. 1 Clear		N/A

2.4 MANUFACTURED WOOD FRAMING AND STRUCTURAL MEMBERS:

2.4.1 Oriented Strand Board and Laminated Veneer Lumber (OSB/LVL) I-Joists: OSB/LVL I-joists shall be designed and fabricated to fit the dimensions and loads indicated on the plans or match the I-joists being replaced. I-joist flange members, web members and adhesives shall conform to the provisions of NES 200 and be tested and evaluated in accordance with ASTM D5055.

2.4.2 Laminated Strand Lumber (LSL): LSL shall be designed and fabricated to fit the dimensions and loads indicated on the plans or match the LSL being re-

placed. Materials used for the fabrication of LSL shall conform to the provisions of NES 481. Adhesives shall conform to ASTM D2559.

2.4.3 Laminated Veneer Lumber (LVL): LVL shall be designed and fabricated to fit the dimensions and loads indicated on the plans or match the LVL being replaced. Materials used for the fabrication of LVL shall conform to the provisions of NES 126. Adhesives shall conform to ASTM D2559.

2.4.4 Parallel Strand Lumber (PSL): PSL shall be designed and fabricated to fit the dimensions and loads indicated on the plans or match the PSL being replaced. Materials used for the fabrication of PSL shall conform to the provisions of NES 292. Adhesives shall conform to ASTM D2559.

2.5 PARTICLEBOARD: Particleboard shall conform to ANSI A208.1 or CS 236, and be the thickness, type, density, and class indicated on the plans. Each piece of particle board shall bear the type, density, class, mill number, and Commercial Standard governing its manufacture.

2.6 PLYWOOD: Plywood and plywood siding shall conform to PS 1. Plywood shall be the thickness, grade, species group or identification index, type, and have the type glue indicated on the plans. Each piece of plywood shall bear the stamp of a nationally recognized inspection agency indicating the grade of face and back veneers, species group or identification index, type of plywood, type of glue, mill number, and Product Standard governing its manufacture. Plywood shall have a span rating equal to or greater than the actual in-place span.

2.7 SUBFLOOR AND UNDERLAYMENT: Plywood subfloor and underlayment shall conform to PS 1. Hardboard underlayment shall conform to ANSI A135.4 or PS 58. Oriented Strand Board (OSB) underlayment shall be Weyerhaeuser .225 inch thick Structured underlayment. OSB underlayment shall be manufactured to a .005 inch tolerance in thickness using marine grade resin. OSB underlayment shall be warranted by the manufacturer not to warp, buckle, or delaminate. Thickness of plywood and hardboard shall match the thickness of the subfloor and/or underlayment panels being replaced. Plywood and hardboard shall be type, class, grade, and exposure durability classification indicated below.

2.7.1 Plywood Subfloor:

2-4-1 Grade, Group 1, Exterior or Interior with Exterior Glue
C-C Grade, Group 1, Exterior

2.7.2 Plywood Floor Underlayment:

Underlayment Grade, Exterior or Interior with Exterior Glue
C-C Plugged Grade, Exterior or Interior with Exterior Glue
A-C Underlayment Grade, Exterior
A-C Grade, Exterior (Plugged Crossbands Under Face)

2.7.3 Plywood Roof Underlayment:

C-D Grade, Exterior or Interior with Exterior Glue

2.7.4 Lauan Plywood Floor Underlayment:

Type I - Exterior, Class BB

2.7.5 Hardboard Floor Underlayment:

Type 1, Tempered, Underlayment Grade

2.7.6 Oriented Strand Board Floor Underlayment:

Weyerhaeuser Structurwood Underlayment

PART 3 EXECUTION

3.1 GENERAL: Perform rough carpentry as indicated on the plans and specified herein.

3.2 CARPENTRY: Perform carpentry in accordance with NFOPA 01 and 02, the applicable portions of HUD 4930.1, and commonly accepted professional carpentry practices.

3.3 PLYWOOD: Plywood shall be applied with edges 1/8 inch apart at side and end joints, and nailed at supported edges at a minimum of 6 inches on center and at intermediate supports 12 inches on center. Plywood shall be applied with long dimension at right angles to supports, and end joints made over supports.

3.4 NAILING: Nailing shall be in accordance with the details contained on the drawings, except where detailed nailing requirements are not specified, then the nail size and spacing shall be per the recommended nailing schedule as contained in NFOPA-02. The nail size and spacing shall be sufficient to develop an adequate strength for the connection without splitting the members. Nailing at plywood edges shall be 3/8 inch from any edge.

DIVISION 6 - WOOD AND PLASTICS

SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the accomplishment of finish carpentry required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Wood Preservers Association (AWPA) Standard:

C2 — Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes.

1.2.2 Architectural Woodwork Institute (AWI) Publication:

02 — Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program.

1.2.3 Southern Pine Inspection Bureau (SPIB) Publication:

Grading Rules for Southern Pine Lumber.

1.2.4 West Coast Lumber Inspection Bureau (WCLIB) Publication:

Grading Rules For West Coast Lumber.

1.2.5 Western Wood Products Association (WWPA) Publication:

Grading Rules for Western Lumber.

1.2.6 Wood Moulding and Millwork Producers Association (WMMPA) Publications:

WM 4 — Quality Standard for Wood Moulding.

WM 6 — Industry Standard for Non-Pressure Treating of Wood Millwork.

WM 7 — WM/Series Wood Moulding Patterns.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major lumber and materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.3 Samples: Submit color and pattern samples for selection of colors and patterns, when applicable.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ADHESIVES AND FASTENERS: Adhesives and fasteners shall be the proper product for the intended application. Adhesives shall be waterproof. Fasteners exposed to the weather shall be aluminum alloy, cadmium, zinc-plated steel, or other noncorrosive metal.

2.3 MOULDING: 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. Materials shall be graded in accordance with SPIB Grading Rules, WCLIB Grading Rules For West Coast Lumber, or WWPA Grading Rules for Western Lumber. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks. 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. Moisture content of all material shall be in accordance with the standard under which the product is produced.

2.3.1 Trim: Trim shall be WWPA-01 choice oak.

2.3.2 Mouldings: Moldings shall be of the pattern indicated and shall be of a grade compatible with the finish specified. Wood moulding and millwork shall conform to WMMPA WM 4 and be nonfinger-jointed clear white pine or poplar. Unless otherwise indicated on the plans, sizes and profiles of moulding and millwork shall be as indicated in WMMPA WM 7. When applicable, sizes and profiles of moulding and millwork shall match the items to be replaced. Moulding and millwork may be produced at a commercial mill or the Contractor's own millroom. Exterior moulding and millwork shall be pressure treated in accordance with AWPA C2, non-pressure treated in accordance with WMMPA WM 6, redwood, or cedar.

PART 3 EXECUTION:

3.1 GENERAL: The Contractor shall perform all finish carpentry work as indicated on the plans and specified herein.

3.2 CARPENTRY: Carpentry shall be accomplished in accordance with AWI 02 and commonly accepted professional finish carpentry practices.

3.3 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. fasciae 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.

3.4 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 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.

DIVISION 6 - WOOD AND PLASTICS

SECTION 06410

CUSTOM CASEWORK

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation of custom casework required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standards:

A135.4	Basic Hardboard.
A156.9	Cabinet Hardware.
A161.1	Recommended Construction and Performance Standards for Kitchen and Vanity Cabinets.
A208.1	Mat-Formed Wood Particleboard.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

D702	Cast Methacrylate Plastic Sheets, Rods, Tubes, and Shapes.

1.2.3 California Redwood Association (CRA) Publication:

Standard Specifications for Grades of Redwood Lumber.

1.2.4 Federal Specifications (FS):

MMM-A-130	Adhesive, Contact.
TT-S-176	Sealer, Surface, Varnish Type, Floor, Wood or Cork.
L-P-508	Plastic Sheet, Laminated, Decorative, and Non Decorative.
TT-S-1543	Sealing Compound: Silicone Rubber Base (For Calking, Sealing, and Glazing in Buildings and Other Structures).

1.2.5 Flat Glass Marketing Association (FGMA) Publication:

Glazing Manual.

1.2.6 International Association of Plumbing and Mechanical Officials (IAPMO) Publication:

Uniform Plumbing Code (UPC).

1.2.7 National Association of Plumbing-Heating-Cooling Contractors (NAPHCC) Publication:

01	National Standard Plumbing Code (NSPC).

1.2.8 National Electrical Manufacturer's Association (NEMA) Standards:

LD 3	High-Pressure Decorative Laminates.
LD 3.1	Performance, Application, Fabrication, and Installation of High-Pressure Decorative Laminates.

1.2.9 Southern Pine Inspection Bureau (SPIB) Publication:

Grading Rules for Southern Pine Lumber.

1.2.10 U.S. Department of Commerce Commercial Standards (CS) and Product Standards (PS):

CS 236	Mat-Formed Wood Particleboard.
PS 1	Construction and Industrial Plywood.
PS 20	American Softwood Lumber Standard.
PS 51	Hardwood and Decorative Plywood.
PS 58	Basic Hardboard.

1.2.11 Western Wood Products Association (WWPA) Publication:

Grading Rules for Western Lumber.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: Submit samples of cabinet finishes, doors and hardware, countertops, and other materials for selection of colors, patterns and design.

1.3.3 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.4 Shop Drawings: Submit shop drawings of the proposed fabrication and installation of cabinets, countertops and display cases. Shop drawings shall indicate size and types of all materials, components, fasteners, and hardware.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ACRYLIC PLASTIC SHEETS: Acrylic plastic sheets shall conform to ASTM D702, Type II, Grade 3, smooth on both sides, and the size indicated on the plans. Colors shall be selected by the Contracting Officer from samples provided by the Contractor.

2.3 ADHESIVES AND FASTENERS: Adhesives and fasteners shall be the proper product for the intended application. Adhesives shall be waterproof and dry clear. Exposed fasteners on cabinets shall be brass or match the cabinet hardware. Adhesive for cementing decorative laminated plastic sheet to core materials shall be contact adhesive conforming to FS MMM-A-130 and the high-pressure plastic laminated sheet manufacturer's written recommendations. High-pressure plastic laminates shall be applied in accordance with NEMA LD 3.1.

2.4 CABINETS: Cabinet design and construction shall conform to ANSI 161.1 and the requirements herein. Standard construction plywood shall conform to PS 1. Softwood lumber shall conform to PS 20. Hardwood plywood shall conform to PS 51. Particleboard shall conform to ANSI A208.1 or CS 236, Type 2, Grade B, Class 2. Plastic laminate shall conform to FS L-P-508 and NEMA LD 3, Class II, and be 0.042 inch thick. Base cabinets shall be 24 inches deep and 34 1/2 inches high. Wall cabinets shall be 12 inches deep and the height indicated.

2.4.1 Frameless Style Cabinets:

2.4.1.1 Fronts and Framing: None.

2.4.1.2 Bottoms, Backs, Ends, and Tops: Bottoms, ends, and tops of base and wall cabinets shall be 3/4 inch particleboard with a plastic laminate exterior and Melamine interior. Backs of base and wall cabinets shall be 1/2 inch particleboard with a Melamine finish on all exposed surfaces.

2.4.1.3 Shelves: Shelves shall be 3/4 inch particleboard with a Melamine finish on all exposed surfaces. Shelves shall be vertically adjustable in 1-1/4 inch increments and be supported on the ends and on 24 inch centers. Unless otherwise specified, all base cabinets, except sink base cabinets, shall have one full width and depth shelf. Unless otherwise indicated, all wall cabinets, shall have two full width and depth shelf.

2.4.1.4 Doors and Drawer Fronts: Doors and drawer fronts shall be 3/4 inch particleboard with a plastic laminate exterior and Melamine interior. Door and drawer front design shall be selected by the Contracting Officer from samples provided by the Contractor.

2.4.1.5 Drawers: Drawer sides, backs and bottoms shall be 5/8 inch particleboard with a Melamine finish on all exposed surfaces.

2.4.1.6 Hardware: Hardware shall conform to ANSI A156.9. Hardware shall be corrosion resisting steel or brass, and the finish and design selected by the Contracting Officer from samples provided by the Contractor. Hinges shall be concealed self-closing European type with a minimum 120 degree swing. Drawers shall have nylon rollers and be mounted on 20-gauge steel drawer slides and drawer guides, both with a factory-applied baked epoxy enamel finish. Slides and guides shall be full extension and have a 100 pound minimum load capacity.

2.4.1.7 Finish: Plastic laminate exteriors and Melamine interiors. All surfaces shall be finished.

2.4.1.8 Toe Kicks: Toe kicks shall be 3/4 inch particleboard with a plastic laminate exterior and Melamine interior.

2.5 COUNTERTOPS: Install plastic laminate countertops as indicated.

2.5.1 Plastic Laminate: Countertops shall be constructed of 3/4 inch particleboard conforming to ANSI A208.1 or CS 236, Type 2, Grade B, Class 2; and high-pressure plastic laminate sheet, not less than 0.048 inch thick, conform-

ing to FS L-P-508 and NEMA LD 3; and be the size indicated on the plans. Splices will not be allowed on countertops 12 feet or less long. Countertops shall be self-edged type. Edges of countertops shall be finished with high-pressure plastic laminate sheet, cut, fitted and trimmed, to fit all exposed countertop edges. Backsplashes and endsplashes when indicated shall be constructed the same as the countertops. Colors and patterns of high-pressure plastic laminate shall be selected by the Contracting Officer from samples provided by the Contractor.

2.6 HARDBOARD: Hardboard shall conform to ANSI A135.4 or PS 58, and be the thickness, class, and finish indicated on the plans. Each piece of hardboard shall bear the stamp of a nationally recognized inspection agency indicating the class, finish, manufacturer, and Product Standard governing its manufacture.

2.7 HARDWARE: Miscellaneous hardware, metal items, and other specialty items shall be provided and installed as required to accomplish the required work.

2.8 LUMBER: All lumber shall conform to PS 20, be surfaced on all four sides (S4S), and the size and type indicated on the plans. Each piece of visually graded lumber shall bear the stamp of a nationally recognized lumber grading agency indicating the grading rules under which it was produced, species, and grade. Each piece of machine stress-rated lumber shall bear the stamp of a nationally recognized lumber grading agency indicating the grading rules under which it was produced, species, correlated fiber stress in bending, and modulus of elasticity. Unless otherwise indicated on the plans, lumber may be any species and grade listed in CRA Standard Specifications for Grades of Redwood Lumber, SPIB Grading Rules, or WWPA Grading Rules for Western Lumber which have the minimum design values listed below.

Lumber Use Category	Minimum Fiber Stress In Bending "Fb" Single	Minimum Fiber Stress In Bending "Fb" Repetitive	Minimum Fiber Stress Elasticity "E"
Light General Framing.	675	775	900,000
Miscellaneous Trim and Boards.	No. 2 Common or Better		N/A
Trim and Shelf Boards.	No. 1 Clear		N/A

2.9 PARTICLEBOARD: Particleboard shall conform to ANSI A208.1 or CS 236, Type 2, Grade B, Glass 2, and be the thickness indicated on the plans. Each piece of particleboard shall bear the stamp of a nationally recognized inspection agency indicating type, density, class, mill number, and Commercial Standard governing its manufacture.

2.10 PLASTIC LAMINATE: Plastic laminate shall conform to FS L-P-508 and NEMA LD 3, Class II, and be 0.042 inch thick. Colors and patterns shall be selected by the Contracting Officer from samples provided by the Contractor.

2.11 PLYWOOD: Construction and industrial plywood shall conform to PS 1. Hardwood and decorative plywood shall conform to PS 51. Plywood shall be the thickness, grade, species group or identification index, type of plywood, type of glue, mill number, and Product Standard governing its manufacture.

2.12 SEALER: Sealer to be used to seal raw edges of countertop core at miters, seams, and sink cutouts, shall conform to FS TT-S-176.

2.13 SEALING COMPOUND: Sealing compound to be used to seal under sink rims and at the joints between walls, backsplashes, and end splashes shall be paintable, nonhardening, white silicone rubber base sealant which conforms to FS TT-S-1543.

2.14 WALL SHELVES: Wall shelves shall be fabricated from plywood with a hardwood edge on all exposed sides. Shelves shall be primed and painted with gloss enamel paint which matches the surrounding wall surfaces.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall fabricate and install custom casework as indicated on the plans and specified herein.

3.2 FABRICATION AND INSTALLATION: Fabrication and installation of custom casework shall be accomplished in accordance with the manufacturer's written installation instructions, the Contractor's approved shop drawings, and the requirements herein.

3.2.1 Casework: Casework shall be installed level, plumb, and true to line with suitable fasteners to securely anchor each unit. Hardware shall be installed as indicated on the plans. Closer strips, filler strips, toe kick cover strips, and finish molding shall be provided as required. Prior to final acceptance, doors shall be aligned, hardware adjusted, and cabinets left in a clean and neat condition.

3.2.2 Countertops: Countertops shall be installed level, plumb, and true to line with suitable fasteners. Joints between walls, backsplashes, and end splashes shall be sealed with the silicone sealer previously specified. End caps shall be installed on all exposed ends of countertops.

3.2.2.1 Miters and Splices: Miters and splices shall be accomplished in accordance with countertop manufacturer's written instructions using equipment capable of producing straight, tight, even miters and splices. Prior to joining miters and splices, the raw edges of core material shall be sealed with 2 coats of the sealer previously specified. The undersides of miters and splices shall be fastened with 2 mortised screw type clamps, and reinforced with 1 by 4 lumber glued and stapled to the bottom of the countertop the full length of the miter or splice. Splices will not be allowed on countertops 12 feet or less long.

3.2.2.2 Sink Cutouts: Prior to sink installation, the raw edges of core material shall be sealed with 2 coats of the sealer previously specified. Rims of sinks shall be sealed with the silicone sealer previously specified.

3.2.3 Shelves: Shelves shall be installed level, and true to line with suitable fasteners and anchors.

3.3 GLAZING: Glazing shall conform to the FGMA Glazing Manual and any applicable manufacturer's written installation instructions.

3.4 FINISHING: Cabinets and display cases shall be finished as specified in SECTION 09920, INTERIOR PAINTING.

3.5 PLUMBING: Plumbing work required for installation of sinks and faucets shall be accomplished in accordance with the UPC and NAPHCC 01.

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07210	Building Insulation
07220	Roof and Deck Insulation
07242	Exterior Waterproofing Finish System
07270	Firestopping
07535	Modified Bitumin Sheet Roofing
07600	Flashing and Sheet Metal
07710	Manufactured Roof Specialties
07820	Skylights
07920	Caulking and Sealant

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07210

BUILDING INSULATION

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of building insulation and vapor barriers required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

C665	Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
D4397	Polyethylene Sheeting for Construction, Industrial and Agricultural Applications.
E84	Surface Burning Characteristics of Building Materials.
E96	Water Vapor Transmission of Materials.

1.2.3 Federal Specifications (FS):

HH-I-521	Insulation Blanket, Thermal (Mineral Fiber, for Ambient Temperatures).
HH-I-1972	Insulation Board, Thermal, Faced, Polyurethane or Polyisocyanurate.
HH-I-1972/1	Insulation Board, Thermal, Polyurethane or Polyisocyanurate, Faced with Aluminum Foil on Both Sides of the Foam.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified. Unless otherwise specified, all insulating materials shall have a Class A flame spread and smoke developed classification when tested in accordance with ASTM E84. Insulation packaging and individual pieces of material shall be marked or labeled showing the R-value of installed thicknesses and the certified burning characteristics.

2.2 POLYURETHANE OR POLYISOCYANURATE FACED BOARD INSULATION: Faced polyurethane or polyisocyanurate board type insulation shall conform to FS HH-I-1972 and HH-I-1972/1, Class 1 or 2. Facing material shall be aluminum foil on both sides of the board.

2.3 SOUND ATTENUATION BLANKETS: Sound attenuation blankets shall be unfaced fiberglass batt and blanket insulation and conform to FS HH-I-521, Type I; or ASTM C665, Type I.

2.4 VAPOR BARRIER MATERIAL: When a separate vapor barrier material is indicated, it shall be polyethylene sheet conforming to ASTM D4397, and .006 inch thick. All vapor barrier material shall have a perm rating less than 0.1 when tested in accordance with ASTM E96.

2.5 SPRAY APPLIED INSULATION: Spray applied insulation shall consist of two or more components that are combined on site and immediately applied to the building surface to create a minimum one (1) inch thick thermal barrier. The insulation components, mixing and application processes shall be proprietary and be warranted by the manufacturer. Spray applied insulation shall have the following characteristics:

2.5.1 Minimum R Value: 3.6 per inch

2.5.2 Flame Spread: <25 (ASTM E 84)

2.5.3 Smoke Development: <450 (ASTM E 84)

2.5.4 CFC or HCFC: None

2.5.5 Application: Vertical and Horizontal Surfaces

2.5.6 Fungus & Bacteria: Resistant

2.5.7 Manufacturer: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to Monoglass Incorporated (888.777.2966) and Icynene Incorporated (888.946.7325).

PART 3 EXECUTION

3.1 GENERAL: Install insulation and vapor barriers in the locations, types, and thicknesses as indicated on the plans.

3.2 INSTALLATION: Install insulation and vapor barriers in accordance with the manufacturer's written installation instructions. Seal vapor barriers tightly to prevent moisture migration. Patch or replace damaged vapor barriers. When more than one layer of insulation is installed together, only the interior layer of insulation shall have a vapor barrier.

3.2.1 Spray applied insulation shall not start until all hangars and other concealed attachments have been made to the surface being coated. Coordinate with suspended ceiling installer to install spray applied insulation before the ceiling grid is installed.

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07220

ROOF AND DECK INSULATION

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials and transportation necessary for the installation of roof and deck insulation required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

C165	Standard Method for Measuring Compressive Properties of Thermal Insulations.
C208	Insulating Board (Cellulosic Fiber), Structural and Decorative.
C552	Cellular Glass Block and Pipe Thermal Insulation.
C578	Preformed, Cellular Polystyrene Thermal Insulation.
C726	Mineral Fiber and Mineral Fiber, Rigid Cellular Polyurethane Composite Roof Insulation Board.
D41	Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
D226	Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
D312	Asphalt Used in Roofing.
D2178	Asphalt Glass Felt Used in Roofing and Waterproofing.
D2626	Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing.
D2822	Asphalt Roof Cement.
E84	Surface Burning Characteristics of Building Materials.
E96	Water Vapor Transmission of Materials in Sheet Form.

1.2.2 Federal Specifications (FS):

SS-C-153	Cement, Bituminous, Plastic.
HH-I-526	Insulation Board, Thermal (Mineral Fiber).
HH-I-530	Insulation Board, Thermal, Unfaced, Polyurethane or Polyisocyanurate.
HH-I-1972	Insulation Board, Thermal Faced, Polyurethane or Poly-

isocyanurate.

HH-I-1972/1	Insulation Board, Thermal, Polyurethane or Polyisocyanurate, Faced with Aluminum Foil on Both Sides of Foam.
HH-I-1972/2	Insulation Board, Thermal, Polyurethane or Polyisocyanurate, Faced with Asphalt/Organic Felt, Asphalt/Asbestos Felt of Asphalt/Glass Fiber Felt on Both Sides of the Foam.
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 the Other Side of the Foam.
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.

1.2.3 Factory Mutual Engineering Corporation (FM) Publication:

1-28S	Wind Uplift Pressure on Roofs.

1.2.4 National Roofing Contractor's Association (NRCA) Publication:

Roofing and Waterproofing Manual.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.3 Shop Drawings:

1.3.3.1 Submit shop drawings for tapered insulation installations. The drawings shall indicate the slope, size of boards, all roof units and numbering system for insulation panels.

1.3.3.2 Submit shop drawings showing mechanical fastener spacing for insulation attached to nailable decks. Fastener spacing shall be capable of withstanding velocity pressures calculated for each particular roof section. Velocity pressures to be computed in accordance with FM 1-28S.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified. Unless otherwise specified, all insulating materials shall have a Class A flame spread and smoke developed classification when tested in accordance with ASTM E84. Insulation packaging and individual pieces of material shall be marked or labeled showing the R-value or U-value of installed thicknesses and the certified burning characteristics.

2.2 ADHESIVE: Adhesive for application of insulation shall be the type specified by the insulation manufacturer for the particular application involved.

2.3 ANCHORS AND FASTENERS: Anchors and fasteners shall be the type and size specified by the insulation manufacturer for the particular application involved.

2.4 ASPHALT: Asphalt for roofing shall conform to ASTM D312, Type III.

2.5 ASPHALT PRIMER: Asphalt primer shall conform to ASTM D41.

2.6 ASPHALT AND BITUMINOUS CEMENT: Asphalt roof cement shall conform to ASTM D2822. Bituminous cement shall conform to Federal Specification SS-C-153.

2.7 FIBERBOARD INSULATION (UNDERLAYMENT): Fiberboard insulation shall conform to ASTM C208 and HH-I-526. Fiberboard insulation shall have a maximum compressive resistance of 35 psi as per ASTM C165 and be attached and flute span (metal deck) in accordance with the insulation board manufacturer's recommendations. Insulation boards shall be a minimum of 1/2 inch thick and may be plain or impregnated with a maximum of 4 percent asphalt by weight.

2.8 POLYURETHANE AND POLYISOCYANURATE INSULATION:

2.8.1 Unfaced: Unfaced polyurethane and polyisocyanurate insulation board shall conform to FS HH-I-530, Type I.

2.8.2 Unfaced Tapered: Tapered polyurethane and polyisocyanurate insulation shall conform to Federal Specification HH-I-530, Type I. Insulation shall be sloped as required to meet the indicated drainage but shall not be less than 1/8 inch per foot.

2.8.3 Felt Faced: Polyurethane and polyisocyanurate insulation board faced with asphalt/organic felt or asphalt/glass fiber felt on both sides of the foam shall conform to FS HH-I-1972 and HH-I-1972/2, Class 1, 2, 3, or 4.

2.9 VAPOR RETARDER:

2.9.1 Asphalt-Saturated Felt: Asphalt-saturated felt shall conform to ASTM D226, Type I or ASTM D2178, Type IV.

2.9.2 Asphalt-Saturated Base Sheet: Asphalt-saturated base sheet shall conform to ASTM D2626, Type I or II.

PART 3 EXECUTION

3.1 GENERAL: Install and replace roof and deck insulation as indicated on the plans and specified herein.

3.2 WEATHER LIMITATIONS: Do not install roof and deck insulation during inclement weather or when the ambient temperature is less than 40 degrees F. Protect building interiors from the effects of the weather at all times during the course of the work. Damage to interiors of buildings during the course of the work due to the failure of the Contractor to protect the interiors shall be repaired by the Contractor at no additional cost to the Government.

3.3 PREPARATION: Remove existing roof and deck insulation to the extent indicated.

3.4 INSTALLATION: Install roof and deck insulation in accordance with the NRCA Roofing and Waterproofing Manual, the insulation manufacturer's written installation instructions, approved shop drawings, and the requirements herein. Apply insulation, roofing, and flashings to a smooth and firm surface free from ice, frost, moisture, dirt, projections, and foreign materials. Co-ordinate installation of insulation with the installation of roofing and flashings so that all materials applied each day are waterproofed that day.

3.5 APPLICATION OF ASPHALT: Asphalt shall not be heated to a temperature above the manufacturer's listed flash point. Heating kettles shall be equipped with thermometers, and kettlemen shall be in attendance at all times to insure that the maximum temperature specified is not exceeded. Temperature of bitumen at the time it is applied shall be in accordance with manufacturer's listed eviscous temperature (EVT). Application temperatures shall be measured at the mop bucket and/or mechanical applicator. Each layer of felt shall be laid in not less than 20 pounds or more than 30 pounds of asphalt per square. Prime concrete surfaces prior to application of asphalt.

3.6 INSTALLATION OF INSULATION:

3.6.1 Insulation shall be laid in one or more layers. Units of insulation shall be laid in parallel courses parallel with the roof slope. End joints shall be staggered. Insulation shall be cut to fit neatly against adjoining surfaces. If installed in more than one layer, joints in successive layers shall be staggered with respect to joints or preceding layer. Insulation which can be readily lifted after installation is not considered to be adequately secured.

3.6.2 Bitumen shall not be applied further than one panel length ahead of roof insulation being installed. Asphalt primer shall be applied at the rate of 1 gallon per square over the entire surface to be mopped when the insulation is applied directly to concrete deck. The first layer of insulation shall be laid in adhesive or solid mopping of bitumen in accordance with manufacturer's printed recommendations. All successive layers shall be laid in solid moppings of hot bitumen applied at the rate of at least 20 pounds of asphalt per square.

3.6.3 When mechanical fasteners are used for insulation installed in two or more layers, only the top layer need be secured with fasteners. When using serrated nail-type fasteners for steel decks and through an asphalt covering, a hole will be prepunched in the covering. All fasteners which do not anchor solidly into the deck shall be removed.

3.6.4 The insulation shall be kept dry at all times and shall be laid just before application of the roofing felts. No more insulation shall be laid than can be covered the same day with the complete roofing system. Exposed edges of the insulation shall be protected by the cutoffs at the end of each days work or whenever precipitation is imminent. Cutoffs shall be two layers of bituminous-saturated felt set in plastic bituminous cement. Cutoffs shall be removed when work is resumed.

3.7 INSTALLATION OF VAPOR RETARDER: Vapor retarder shall be laid free of wrinkles, creases or fishmouths, at right angles to the slope of the deck, immediately behind the asphalt applicator. The surface of the vapor retarder shall be broomed-in full width to obtain complete adhesion and to eliminate air pockets. The method of mopping a half-sheet width and turning the sheet back to mop under the other half shall not be permitted. Workmen shall not walk on nor shall equipment pass over mopped surfaces until the butumen has reached its set.

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07242

EXTERIOR WATERPROOFING FINISH SYSTEM

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of exterior waterproofing finish system (EWFS) required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Publications shall be assumed to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

B117	Salt Fog Resistance.
D968	Standard Specification for Flat Non-Asbestos Fiber-Cement Sheets.
D2370	Test for Break load and Elongation of Textile Fabrics.
E84	Surface Burning Characteristics of Building Materials.
E96	Water Vapor Transmission of Materials.
G26	Operating Light and Water Exposure Apparatus (Carbon-Arc Type) for Exposure of Non-Metallic Materials.

1.2.2 Federal Specifications (FS):

TT-P-29	Paints, Latex Base, Interior, Flat, White and Tints.
TT-C-555B	

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: The Contractor shall submit color and texture samples for selection of colors and textures. Once color and texture have been selected, the Contractor shall submit two 2 by 4 foot samples of the high performance elastomeric coating applied with the same tools and techniques as the actual project.

1.3.3 Installation and Maintenance Instructions: The Contractor shall submit manufacturer's written installation and maintenance instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items,

and the most current design which conforms to the requirements herein. All components of a complete system shall be provided by a single manufacturer.

2.2 EXTERIOR WATERPROOFING FINISH SYSTEM:

2.2.1 Coating Characteristics: The exterior waterproofing finish system shall meet the following performance characteristics.

PERFORMANCE CHARACTERISTIC	TEST METHOD	RESULTS
Water vapor transmission	ASTM E96	Perms = 12
Accelerated weathering	ASTM G26	5000 Hrs – No defects
Salt fog resistance	ASTM B117	300 Hrs – No defects
Elongation	ASTM D412	@ 0 Degrees F = 115%
Tensile strength	ASTM D2370	@ 0 Degrees F = 887 psi
Abrasion resistance	ASTM D968	3000 L sand = 0 mils abraded
Rain resistance	TT-C-555B	No water penetration
Mildew resistance	TT-P-29	21 days = Resistant
Surface burning characteristics	ASTM E84	Flame Spread = 5

2.2.2 Color and Texture: Color and texture of exterior waterproofing finish system shall be selected by the Contracting Officer from the full range of manufacturer’s samples provided by the Contractor.

2.2.3 Crack Filler: Crack filler shall consist of a water based, acrylic , internally plasticized, elastomeric material that is non-sag, weatherproof and has good adhesion to concrete and a variety of other substrates. Crack filler may be brush or knife grade and capable of filling gaps up to 1/4 inch in width. Filler must be compatible with the high performance elastomeric coating, with matching texture and no “shine through”.

2.2.4 Primer: Primer shall be a water based formulation made with ultra fine acrylic resins, suitable for the substrate indicated and compatible with the top coating.

2.2.5 Sealants: Sealants and sealant systems shall be those recommended by the exterior waterproofing finish system manufacturer.

2.2.6 Manufacturer: Exterior waterproofing finish system shall be manufactured by ChemRex, Thoro product line, or an approved equal.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install the exterior waterproofing finish system as indicated on the plans and specified herein.

3.2 PREPARATION: Preparation of surfaces to receive the exterior waterproofing finish system shall be accomplished in accordance with the system manufacturer's written substrate preparation instructions.

3.3 INSTALLATION: Installation of the exterior waterproofing finish system shall be accomplished in accordance with the manufacturer's written installation instructions and the Contractor's approved shop drawings.

3.3.1. Remove existing surface mounted appurtenances, such as downspouts and light fixtures prior to installation. Reinstall removed items after finish is complete.

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07270

FIRESTOPPING

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of firestopping required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

E84	Surface Burning Characteristics of Building Materials.
E136	Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C.
E814	Fire Tests of Through-Penetration Fire Stops.

1.2.2 National Fire Protection Association (NFPA) Publication:

70	National Electrical Code (NEC).

1.2.3 Underwriters Laboratories (UL) Publications:

1	Building Materials Directory.
723	Surface Burning Characteristics of Building Materials.
1479	Fire Tests of Through-Penetration Firestops.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 FIRESTOPPING MATERIALS: Firestopping materials shall consist of commercially manufactured products complying with the following minimum requirements:

2.2.1 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 E84 or UL 723.

2.2.2 Seal Activation: Material shall not require a rise in temperature to activate an effective seal (i.e. intumescent materials).

2.2.3 Nontoxicity: Material shall be nontoxic to human beings at all stages of application and during fire conditions.

2.2.4 Fire Resistance and Hose Stream Tests: Firestopping materials shall be rated "F" and "T" in accordance with ASTM E814 or UL 1479 except that the "T" rating may be based on thermocouple placed one inch from a penetrating item in lieu of direct attachment to penetrating items. Rating periods shall conform to the following:

2.2.4.1 Time-rated floor or wall assemblies: 1 hour.

2.2.5 Combustibility: Material shall be non-combustible when tested in accordance with ASTM E136.

2.2.6 Control and Expansion Joints: Firestopping materials used to impede the passage of smoke and gases through control and expansion joints shall be a type that will not interfere with the expansion/contraction movement requirement of the joints. When installed, firestopping materials shall provide the same time-rated protection at the joints as the adjacent wall ceiling, of floor construction.

PART 3 EXECUTION

3.1 GENERAL: Install firestopping as indicated on the plans and specified herein.

3.2 INSTALLATION: Install firestopping at locations shown or specified in accordance with manufacturer's written instructions. Cutting and patching of construction and providing sleeves, where required, are shown on the plans or specified in other sections.

3.2.1 Locations: Install firestopping in the following locations:

3.2.1.1 Duct, conduit and pipe penetrations through above grade floor slabs and through time-rated partitions and fire walls.

3.2.1.2 Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.

3.2.1.3 The gaps at the joint of the above grade floor slabs and curtain walls.

3.2.1.4 Other locations where shown.

3.2.1.5 Gaps at perimeters of time-rated partitions and fire walls, such as between the top of fire walls and the bottom of roof decks.

3.2.1.6 Control and expansion joints.

3.2.2 Filling of Voids: Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerances established by the manufacturer. Firestopping for filling voids in floors in which the smallest dimension of the void is 4 inches or more shall support 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.

3.2.3 Pipe and Ductwork:

3.2.3.1 Ductwork: Ductwork penetrating 1 hour assemblies without a fire damper, insulated or uninsulated, shall have the voids between the ductwork or insulation and the prepared opening filled with firestopping material. The material shall be installed as recommended by the manufacturer.

3.2.3.2 Fire Dampers: Fire dampers in ducts and penetrations of time-rated construction shall be furnished and installed in accordance with the requirements in SECTION 15880, AIR DISTRIBUTION EQUIPMENT.

3.2.4 Electrical Cables or Conduits: Electrical cables or conduit penetrating time-rated assemblies shall be firestopped as listed in the Underwriters Laboratories. Firestopping at penetrations shall also comply with the requirements of NFPA 70.

3.2.5 Control and Expansion Joints: Continuously fill all voids located behind control or expansion joints in time-rated partitions, ceilings, or floors with firestopping material for the full length of the joints. Firestopping material shall not be attached to the wall or ceiling panels themselves.

3.3 INSPECTION: Firestopped areas shall not be covered or enclosed until inspection is complete and approved.

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07535

MODIFIED BITUMEN SHEET ROOFING

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of modified bitumen sheet roofing required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

D312 Asphalt Used in Roofing.

D2178 Asphalt Glass Felt Used in Roofing and Waterproofing.

1.2.2 National Roofing Contractors Association (NRCA) Publication:

Roofing and Waterproofing Manual.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.3 Shop Drawings: Submit shop drawings showing the size of sheets, position of sheets and splices, flashing details, nailing patterns for sheets, and expansion joint details.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ANCHORS AND FASTENERS: Anchors and fasteners shall be the type and size specified by the roofing manufacturer for the particular application involved.

2.3 ASPHALT BITUMEN: Asphalt for roofing shall conform to ASTM D312, Type III or IV as recommended by the membrane manufacturer. The EVT, flash point and ASTM specification number and type shall be displayed on each container. Asphalt shall have an EVT no lower than 425 degrees F.

2.3.1 Type III: Type III shall be used on slopes up to and including 1/4 inch per foot.

2.3.2 Type IV: Type IV shall be used on slopes greater than 1/4 inch per foot up to 3 inches per foot.

2.4 ROOFING CEMENT, COATING AND PRIMER: Roofing cement, coating and primer shall be in accordance with the roofing manufacturer's recommendations.

2.5 BASE PLY: Base ply shall be glass-fiber and conform to ASTM D2178, Type IV. The base ply shall be impregnated with asphalt at a minimum rate of 43 pounds per square.

2.6 ROOFING AND FLASHING MEMBRANE: Roofing and flashing membranes shall be a hot mop applied modified bitumen single-ply sheet roofing system. This single-ply membrane shall consist of one or more polyester fiber mats or a combination of fiberglass and polyester mats sandwiched between coatings of SBS (styrene butadiene styrene) modified asphalt. The exposed surface of the membrane shall be embedded with mineral granules or gravel to protect against the effects of ultra-violet rays. The roof and flashing membrane shall have the following minimum properties.

Property	Characteristics
Elongation Tensile Strength	Minimum 2.66 Kg/mm (150 lbs/in @ -18 degrees C. (0 degrees F.)
Ultimate Elongation	Minimum 8%
Low Temp Flexibility	Minimum -30 degrees C. (-22 degrees F.), or above -18 degrees C. (0 degrees F.)
Lap Joint Tensile Strength	Minimum 2.66 Kg/mm (150 lbs/in) @ -18 degrees C. (0 degrees F.)
Granule Embedment	Maximum 2 gram loss
Accelerated Weathering	No cracking or blistering

PART 3 EXECUTION

3.1 GENERAL: Install modified bitumen sheet roofing as indicated on the plans and specified herein.

3.2 WEATHER LIMITATIONS: Do not apply modified bitumen sheet roofing during inclement weather or when the ambient temperature is less than 40 degrees F. Protect building interiors from the effects of the weather at all times during the course of the work. Damage to the interior of buildings during the course of the work due to the failure of the Contractor to protect the interiors shall be repaired by the Contractor at no additional cost to the Government.

3.3 PREPARATION:

3.3.1 Remove existing roofing system to the extent indicated.

3.3.2 Replace damaged, deteriorated, and missing portions of roof deck, fascia, soffits, nailers, and other eave and rake trim as indicated.

3.3.3 Replace flashings, gutters, downspouts, and other sheet metal items as indicated on delivery orders in accordance with SECTION 07600, FLASHING AND SHEET METAL.

3.4 INSTALLATION: Install modified bitumen sheet roofing in accordance with the NRCA Roofing and Waterproofing Manual, the manufacturer's written installation instructions, approved shop drawings, and the requirements herein. Roofing shall be applied to a smooth and firm surface free from ice, frost, moisture, dirt, projections, and foreign materials.

3.5 INSULATION: Install insulation in accordance with SECTION 07220, ROOF AND DECK INSULATION.

3.6 ROOFING MEMBRANE:

3.6.1 Heat welding or torching of a single-ply modified bitumen roofing system is permitted when the following conditions are met. The applicator (torch operator) shall have a minimum of six months of experience using a torch to apply modified bitumen roofing systems or have attended a certified course on the use of a torch for this type of application. A properly charged and operable fire extinguisher shall be present on the roof at all times during use of the torch. The torch shall have a mechanism which will cause the torch to be extinguished when left unattended. Heat welding or torching a single-ply modified bitumen system shall not be allowed over a combustible material without first installing an appropriate base ply (ref. to manufacturer's recommendation).

3.6.2 All laps and seams must be tight, properly sealed with bitumen and overlapped the proper distance recommended by the manufacturer. The manufacturer's selverage shall be completely covered. If no selverage or overlap distances are defined then the following minimums shall be followed: side laps 4 inches; end laps 6 inches.

3.6.2.1 Seal natural voids (the area just inside the lap line on top sheet).

3.6.2.2 Fully adhere the lap surface and bead to obtain adhesion where laps are not sealed.

3.6.2.3 Bond and seal bridging seams. (Bridging is where a parallel field lap crosses a perpendicular lap such as in a stagger end lap pattern.)

3.6.2.4 Excess bitumen, exposed to ultra violet rays, shall be coated with mineral granules before bitumen sets.

3.6.3 Finished roof membrane must be solid and tight. Inspect roof and make necessary corrections/repairs to ensure proper adhesion.

3.6.3.1 Repair burned areas i.e., lightly burned areas require resaturation with extra modified bitumen mix. All other burned areas require patching.

3.6.3.2 Cut open, reheat and patch delaminated areas.

3.6.3.3 Cut out all buckles, blisters and voids and overlay with new membrane.

3.7 FLASHINGS: The base flashing system shall be a component of, or attached to, the roofing membrane. Apply base flashings only after the membrane roofing has been installed. Install in accordance with approved manufacturer's current published details.

3.8 SURFACING: Apply surface material following the approved manufacturer's recommendations concerning quantities and procedures for application of surface coating.

3.9 PROTECTION: Protect unfinished and finished roof areas from damage caused by weather and foot traffic. Unfinished portions of the roof shall be protected by use of glaze coats, water cut offs and temporary flashings. All portions of the roof shall be weathertight at the end of each work day. Provide temporary walkways to protect the finished roof from damage by work crews.

3.10 MODIFIED BITUMEN SHEET ROOFING REPAIRS: Use the following procedures to make permanent torch-down repairs to modified bitumen or built-up roofing membranes. A properly charged and operable fire extinguisher shall be present on the roof at all times during use of the torch.

3.10.1 Cut a patch from a new roll of modified bitumen large enough to extend 3 to 4 in. beyond the damaged area.

3.10.2 The area around the repair should be completely dry and free from dirt and debris. Prime the area around the defect by heating the existing roof membrane with the torch flame. If this method is not permitted, apply a thin coat of asphalt primer and allow to dry completely of all solvent before proceeding.

3.10.3 Put patch down-side up on a small, heavy-gage metal plate. Apply heat to the underside until the bitumen begins to flow. Use the trowel to flip the patch over the area to be repaired.

3.10.4 Press the patch in place with the trowel. Apply heat to the trowel as it is worked around the edge of the patch to get a good bond between the patch edge and the roof. Some melted bitumen should ooze out along the edges to seal the patch.

3.10.5 Use the torch and trowel to seal all edges of the patch with bitumen.

3.10.6 If not enough bitumen has oozed out to properly seal the edges, extra bitumen can be obtained by torching the back of a scrap piece of membrane and scraping off the melted bitumen.

3.10.7 Use a trowel to apply the extra bitumen to seal the edge of the patch.

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07600

FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the fabrication and installation of flashings and sheet metal required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

A653/A653M	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
A755/A755M	Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exposed Building Products.
A875/A875M	Steel Sheet, Zinc-5% Aluminum Alloy-Coated by the Hot-Dip Process.
B32	Solder Metal.
B101	Lead-Coated Copper Sheets.
B209/B209M	Aluminum and Aluminum-Alloy Sheet and Plate.
B221/B221M	Aluminum-Alloy Extruded Bars, Rod, Wire, Shapes, and Tube.
C171	Sheet Materials for Curing Concrete.
D226	Asphalt-Saturated Organic Roofing Felt Used In Roofing and Waterproofing.
D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
D2178	Asphalt Glass Felt Used in Roofing and Waterproofing.
D2822	Asphalt Roof Cement.

1.2.2 Federal Specifications (FS):

SS-C-153	Cement, Bituminous, Plastic.
TT-S-1543	Sealing Compound: Silicone Rubber Base (For Calking, Sealing, and Glazing in Buildings and Other Structures).
TT-S-1657	Sealing Compound: Single Component, Butyl Rubber Based, Solvent Release Type (For Building and Other Types of Construction).

1.2.3 Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Publication:

Architectural Sheet Metal Manual.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.3 Shop Drawings: Submit shop drawings of the proposed flashings and sheet metal items. Shop drawings shall show weights, gauges, or thickness of sheet metal; type of material; joining, expansion-joint spacing, and fabrication details; and installation procedures.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ALUMINUM EXTRUSIONS: Aluminum extrusions shall conform to ASTM B221/B221M, Alloy 6063, Temper T5.

2.3 ANCHORS AND FASTENERS: Anchors and fasteners shall be appropriate for the intended purpose, and compatible with the material being anchored or fastened. Anchors and fasteners shall be rust and corrosion resistant, and be the materialindicated in Table II.

2.4 ASPHALT AND BITUMINOUS CEMENT: Asphalt roof cement shall conform to ASTM D2822. Bituminous cement shall conform to FS SS-C-153.

2.5 Felt: Asphalt-saturated organic roofing felt shall cnform to ASTM D226, Type I. Asphalt-impregnated glass-fiber roofing felt shall conform to ASTM D2178, Type IV.

2.6 BUILDING PAPER: Building paper shall conform to ASTM C171.

2.7 POLYVINYL CHLORIDE MATERIALS: Polyvinyl chloride (PVC) materials shall conform to ASTM D1784.

2.8 SEALANTS: Sealants shall conform to FS TT-S-1543 or TT-S-1657.

2.9 SHEET METAL: Flashing and sheet metal items shall be fabricated from materials which conform to the requirements specified below, and in Table I. Where Table I lists more than one material for a particular item, any listed material may be used, unless otherwise specified. Different items need not be of the same material, except that exposed items when in close proximity to each other shall be of the same material for appearance purposes.

2.9.1 Aluminum Alloy: Aluminum alloy sheet and plate shall conform to ASTM B209/B209M. Form, alloy, and temper shall be appropriate for the intended purpose. Aluminum sheets shall be prefinished with “Kynar 500” or “Hylar 5000”.

2.8.2 Galvanized Steel: Galvanized steel sheet shall conform to ASTM A653/A653M, A755/A755M, or A875/A875M as appropriate for the application.

2.9.3 Lead-Coated Copper: Lead-coated copper sheets shall conform to ASTM B101, Type I, Class A. Copper shall not weigh less than that shown for the item designated in Table I, before the lead-coating.

2.10 SOLDER: Solder shall conform to ASTM B32, alloys appropriate for the application.

2.11 SPLASH BLOCKS: Splash blocks shall be precast concrete 12 by 36 inches.

PART 3 EXECUTION

3.1 GENERAL: Fabricate and install flashing and sheet metal items as indicated on the plans and specified herein.

3.2 INSTALLATION: Fabricate and install flashing and sheet metal items in accordance with SMACNA Architectural Sheet Metal Manual, any applicable manufacturer's written installation instructions, and the requirements herein.

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.

3.4 SOLDERING, RIVETING, SEAMING, AND SEALING: Where soldering is specified, it shall apply only to copper, copper clad stainless steel, and stainless steel items. Where riveting and sealing are specified for aluminum, it shall apply only to aluminum 0.040 inch or less in thickness. Riveting shall apply to either metal as specified.

3.4.1 Soldering: Edges of sheet metal, except lead coated material, 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 lead coated material to be soldered shall be scraped or wire-brushed to produce a bright surface, and seams shall have a liberal amount of flux brushed in before soldering is begun. 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 solution of washing soda in water, and rinsed with clean water. Joints in aluminum sheets 0.040 inch or less in thickness shall be made mechanically and sealed with the sealant specified. Aluminum shall not be soldered.

3.4.2 Seams: Seams shall conform to the following requirements:

3.4.2.1 Flat-lock seams shall finish not less than 1 inch wide.

3.4.2.2 Soldered-lap seams shall finish not less than 1 inch wide.

3.4.2.3 Unsoldered plain-lap seams shall lap not less than 3 inches unless otherwise specified.

3.4.2.4 Flat seams shall be made in the direction of the flow.

3.5 DETAIL REQUIREMENTS: Sheet metalwork shall be accomplished to form weathertight construction. Work shall be installed without waves, warps,

buckles, fastening stresses or distortion and shall allow for expansion and contraction. 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 angle drips. Flashing at the 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. Roof flanges of sheet metal shall be set in bituminous cement over low-slope roofing.

3.6 DOWNSPOUTS: Downspouts shall be set plumb and not less than 1 inch from the wall. Leaders shall connect gutters on overhanging eaves to downspouts. Leaders shall be set with a slope not less than 1/16 inch per foot 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 2 inches. Strainers shall be set loosely in the eave tube opening in gutter. Joints between lengths of downspouts shall be made by telescoping the end of the upper lengths at least 3/4 inch into the lower length. Downspouts terminating in drainage lines shall be neatly fitted into the drainage connection and the joint filled with a portland cement mortar cap sloped away from downspout. Downspouts terminating at splash blocks or splash pans shall be provided with stock elbow-type fittings. Downspout hangers shall be provided adjacent to the joint when splash blocks or splash pans are required. Hangers shall be 1/16 by 1 inch flat stock of the same material as the downspout.

3.7 EXPANSION JOINTS: Expansion joints shall be provided at 32 foot intervals for aluminum, except that where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing, an additional joint shall be provided. Joints shall be evenly spaced. Extruded aluminum gravel stops and fasciae shall be joined by expansion and contraction joints at not more than 12 foot spacing.

3.8 EDGE STRIP: A continuous edge strip shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints shall be spaced approximately 1/8 inch apart. The strip shall be fastened to the supporting construction with nails evenly spaced not over 12 inches on centers. Where the fastening is to be made to concrete or masonry, screws shall be driven in expansion shields set in concrete or masonry. The strip for fascia anchorage shall be installed to extend below the supporting construction to form a drip and allow the flashing to be hooked over the lower edge at least 3/4 inch. The strip shall be of sufficient width to provide adequate bearing area to insure a rigid installation. Where horizontal nailer is vented for insulation, and the strip is placed over masonry or concrete, the strip shall be installed over 1/16 inch thick metal washers placed at screws.

3.9 FLASHINGS: Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, including flashing for heating and plumbing, including piping, roof, and floor drains, and electrical conduit projections through roof or walls. Cap flashings shall be turned around exterior corners of masonry or concrete walls at least 2 inches, and be secured into masonry joints and into concrete with expansion anchors, and sealed with sealing compound. Cap and counter flashing for exterior and interior corners shall be factory-fabricated units. Corner units shall have mitered joints, and be installed with 3 inch lap joint over flashings on each side. Unless otherwise indicated, through-wall flashing shall be terminated 1/2 inch inside each exposed face of the wall. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be covered up by an application of bi-

tuminous plastic cement at the perforation. Flashing shall be installed on top of joint reinforcement.

3.9.1 Counter Flashing: Counter flashing shall extend down past the top edge of the roofing membrane not less than 4 inches. Counter flashing shall be installed at locations indicated and be coordinated with roofing work.

3.9.2 Cap Flashing: Cap flashing shall consist of a two-piece unit with the receiver component fastened to the wall construction and the cap component continuously interlocking into the receiver. Cap flashing shall be sloped to drain and exposed fasteners shall be gasketed.

3.9.3 Through-Wall Flashing: Through-wall flashing includes coping, parapet, sill, lintel, and spandrel flashing. The kind of through-wall flashing material used below the roofline is determined by the width of the wall cavity. 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 be one piece for lintels and sills.

3.9.3.1 Lintel flashing shall extend the full length of lintel. It shall extend through the wall one masonry course above the lintels and be bent down over the vertical leg of the outer steel lintel angle not less than 2 inches, or be applied over top of masonry and precast concrete lintels. Bedjoints of lintels at control joints shall be underlaid with sheet metal bond breaker.

3.9.3.2 Sill flashing shall extend the full width of the sill and not less than 4 inches beyond ends of sill except at control joint where the flashing shall be terminated at the end of the sill.

3.10 GUTTERS: Gutter ends shall terminate at least 1/2 inch away from vertical surfaces. Gutter brackets and spacers shall be fastened to roof nailer by screw shank-type nails or screws, and interlock with or be fastened to the leading edge of gutter. Gutter spacers shall be 1/16 inch by 1 inch flat-stock of the same material as the gutter. Brackets and spacers shall be alternated at not more than 36 inches on centers. Gutters shall be hung with high points equidistant from downspouts and have a slope of not less than 1/16 inch per foot.

3.11 REGLETS: Reglets shall be a factory-fabricated product of proven design, complete with fittings and special shapes as may be 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 8 inches, nor more than 16 inches above roofing not having cant strips, or shall be located not less than 5 inches, nor more than 13 inches above cant strip. Reglet plugs shall be spaced not over 12 inches on centers and reglet grooves filled with sealant. Friction or slot-type reglets shall have metal flashings inserted the full depth of slot and lightly punched every 12 inches to crimp the reglet and cap flashing together.

TABLE I

SHEET METAL WEIGHTS, THICKNESSES, AND GAUGES

Item Description	Copper, Ounces Per	Aluminum Inch	Galvanized & Stainless	Copper Clad Stainless

	SQ Foot		Steel, Inch	Steel, Inch
Exposed Sheet Metal:				
Downspouts, Heads & Leaders:	16	.032	.015	.015
Edge Strip:	24	.050	.025	N/A
Flashings:				
Cap	16	.032	.015	.015
Gutters (Girth):				
Up to 15 inches	16	.025	.018	.018
15 to 20 inches	16	.032	.018	.018
20 to 25 inches	20	.051	.025	.025
25 to 30 inches	24	.064	.031	.031
Gutter Brackets (Girth):				
Up to 15 inches	1/8x1	3/16x1	1/8x1	1/8x1
15 to 20 inches	1/4x1	1/4x1	1/8x1 1/2	1/8x1 1/2
20 to 24 inches	1/4x1 1/2	1/4x2	1/8x2	1/8x2
Gutter Cleats & Cover Plates:	16	.032	.015	.015
Roof Edge:	N/A	N/A	.015	N/A
Scupper Linings:	20	.032	.015	.015
Strainers (Wire Gauge):	No. 9	No. 10	No. 12	N/A
Non Exposed Sheet Metal:				
Bond Breaker	16	N/A	.015	.015
Flashings:				
Through-Wall (Above Roof Line, Including Coping and Parapet):	16	N/A	.015	.015
Through-Wall (Below Roof Line, Including Lintel, Sill and Spandrel Beams):	10	N/A	.010	.010
Parapet Covers:	16	.032	.015	.015
Pitch Pockets:	16	.032	.015	.015
***Reglets:**	10	N/A	.010	.010
Splash Pans:	16	.040	.018	.018

*May be Polyvinyl Chloride.

TABLE II

FASTENER MATERIALS

Type of	Nails	Screws	Rivets	Bolts

Sheet Metal

Aluminum	Aluminum	Aluminum	Aluminum	Aluminum
Galvanized Steel	Galvanized Steel	Galvanized Steel	Galvanized Steel	Galvanized Steel
Lead-Coated Copper	Copper	Bronze	Bronze	Bronze

TABLE III

SHEET METAL JOINTS

Item Description	Copper, Galvanized Steel, Copper Clad Stainless Steel, & Stainless Steel	Aluminum	Remarks
Building Expansion Joint at Roof:	1 1/4 inch single lock standing seam, cleated	1 1/4 inch single standing seam, cleated.	N/A
Edge Strip:	Butt	Butt	N/A
Cap – In Reglet	3 inch lap.	3 inch lap.	*Seal groove with sealant.
Cap – Two Piece	Receiver 3 inch lap. Cap piece 3 inch lap.	N/A	N/A
Through-Wall Lintel & Sill	One piece.	N/A	N/A
Gravel Stops: Extrusions	N/A	Butt with 1/2 inch space.	Use sheet flashing beneath and a cover plate.
Sheet, Smooth	Butt with space.	Butt with space.	Use sheet flashing beneath and a cover plate or a combination unit.
Gutters:	1 1/2 inch lap, riveted and soldered.	1 inch flat locked, riveted, and sealed.	Use hard setting sealant for locked aluminum joints.
Parapet Covers:	Flat lock seam.	Flat lock seam.	N/A
Pitch Pockets:	1 inch soldered lap.	1 inch flat, locked and sealed.	Use hard setting sealant for locked aluminum joints.
Reglets:	Butt joint.	N/A	*Seal reglet groove with sealant.
Roof Edge:	3 inch lap.	N/A	N/A

*Polyvinyl chloride type reglet shall be sealed with manufacturer's recommended butyl rubber sealant.

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07710

MANUFACTURED ROOF SPECIALTIES

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of manufactured roof specialties required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

A167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
A653/A653M	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
A792/A792M	Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process.
A875/A875M	Steel Sheet, Zinc-5% Aluminum Alloy-Coated by the Hot-Dip Process.
B209/B209M	Aluminum and Aluminum-Alloy Sheet and Plate.
B221/B221M	Aluminum-Alloy Extruded Bars, Rod, Wire, Shapes, and Tube.
B370	Copper Sheet and Strip for Building Construction.

1.2.2 National Roofing Contractors Association (NRCA) Publication:

Roofing and Waterproofing Manual.

1.2.3 Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Publication:

Architectural Sheet Metal Manual.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturers descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.3 Shop Drawings: Submit shop drawings of the proposed fabrication and installation of manufactured roof specialties.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturer's regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 COPINGS: Fabricate units of aluminum conforming to ASTM B209; zinc-coated steel conforming to ASTM A653/A653M, coating class G90; or aluminum-zinc coated in accordance with ASTM A792/A792M, coating designation AZ55. Comply with applicable recommendations and details of the SMACNA Architectural Sheet Metal Manual for custom fabricated work. Snap-on coping system fabricated of 24 gauge galvanized sheet metal or .050 aluminum, complete with fascia extender, cleats, chairs, joint covers factory fabricated one-piece corners and any other accessories necessary for a complete system. System will be prefinished with “Kynar 500” or “Hylar 5000” and have no exposed fastenings. Coping system shall be Hickman “Permasnap” coping system or an approved equal.

2.3 COUNTERFLASHING SYSTEMS: Not Used.

2.4 GRAVEL STOPS AND FASCIAS: Not Used.

2.5 RELIEF VENTS: Not Used.

2.6 REGLETS: Not Used.

2.7 ROOF EXPANSION ASSEMBLIES: Not Used.

PART 3 EXECUTION

3.1 GENERAL: Install manufactured roof specialties as indicated on the plans and specified herein.

3.2 INSTALLATION: Install manufactured roof specialties in accordance with their manufacturers’ written installation instructions, the Contractor's approved shop drawings, the NRCA Roofing and Waterproofing Manual, and the requirements herein. Use non-corroding fasteners.

3.2.1 Copings: Securely fastened to curb or parapet with proper type and size fasteners. Joints properly sealed with no gaps.

3.2.2 Counterflashing Systems: Not Used.

3.2.3 Gravel Stops and Fascias: Not Used.

3.2.4 Relief Vents: Not Used.

3.2.5 Reglets: Not Used.

3.2.6 Roof Expansion Assemblies: Not Used.

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07820

SKYLIGHTS

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of skylights required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Publications shall be assumed to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publication:

A525	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
C236	Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box.
C297	Tensile Strength of Flat Sandwich Constructions in Flatwise Plane.
D635	Rate of Buring and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
D1002	Strength Properties of Adhesives in Shear by Tension Loading (Metal-to-Metal).
D1037	Properties of Wood-Base Fiber and Particle Panel Materials.
D1183	Resistance of Adhesives to Cyclic Laboratory Aging Conditions.
D2244	Calculation of Color Differences from Instrumentally Measured Color Coordinates.
E72	Strength Tests of Panels for Building Construction.
E84	Surface Burning Characteristics of Building Materials.

1.2.2. International Conference of Building Code Officials (ICBCO) Publication:

Acceptance Criteria for Sandwich Panel Adhesive.

1.2.3 Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Publication:

Architectural Sheet Metal Manual.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturers descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 MATERIALS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 SKYLIGHT SYSTEMS: Skylight systems shall be as manufactured by Kalwall Corporation, Manchester, New Hampshire, or an approved equal. Skylight systems shall incorporate the following features:

2.2.1 Translucent Facing: Translucent faces shall be manufactured by insulated skylight system fabricator specially for architectural use.

2.2.1.1 Flammability: The interior face sheet shall have a flame spread rating no greater than 45 and smoke developed no greater than 350 when tested in accordance with ASTM E84. Burn extent by ASTM D635 shall be no greater than 1 inch.

2.2.1.2 Weatherability: The exterior faces shall not change color more than 3.0 units (Delta E by ASTM D2244) after 5 years outdoor weathering at 7 degrees facing south determined by the average of at least 3 white samples. An exterior white face sheet shall not darken more than .2 units (Delta L by ASTM D2244) when exposed to 150 degrees F for 2 weeks. The exterior faces shall have a high performance thermoset acrylic protective surface, minimum thickness 1.2 mils, for maximum resistance to erosion and weather, applied in the factory under controlled temperature conditions. This coating must be fully field-refinishable if damaged.

2.2.1.3 Appearance: The face sheets shall be uniform in color to prevent splotchy appearance. Exterior face sheets shall be .070-inch thick and crystal in color. Interior face sheets shall be .045-inch thick and white in color. Faces shall not vary more than +/10 percent in thickness. Faces shall be completely free of ridges and wrinkles which prevent proper surface contact in bonding to the aluminum grid core. Clusters of air bubbles/pinholes which collect moisture and dirt will not be acceptable.

2.2.1.4 Strength: The exterior face sheet shall be uniform in strength and repel an impact equal to 60 foot-pounds without fracture or tear in accordance with SPI Shatter Resistance Test.

2.2.2 Noncombustible Grid Core: The aluminum I-beams shall be 6063-T6 with provisions for mechanical interlocking of muntin-mullion and perimeter to prevent high and low intersections which do not allow full bonding surface to contact with face material. Width of I-beam shall be no less than 7/16-inch. I-beam grid shall be machined to tolerances of not greater than +/- .002-inch for flat panels.

2.2.3 Adhesive: The laminate adhesive shall be heat and pressure resin-type engineered for structural sandwich panel use. Adhesive shall pass testing requirements specified by the ICBCO Publication entitled "Acceptance Criteria for Sandwich Panel Adhesive." Minimum strength shall be:

2.2.3.1 750-psi tensile strength by ASTM C297 after 2 exposures to 6 cycles each of the aging conditions prescribed by ASTM D1037.

2.2.3.2 500-psi shear strength average of 5 exposures by ASTM D1002:

50 percent relative humidity at 73 degrees F.
Accelerated aging by ASTM D1183
182 degrees F.
Full cycle soak
500-hour oxygen bomb

2.2.4 Panel Construction: Skylight panels shall have a thickness of approximately 2 3/4 inches with a "U" factor of .24 as measured by ASTM C236, light transmission of 20 percent and shading coefficient of 0.27.

2.2.4.1 Skylight panels shall be a true sandwich panel of flat fiberglass sheet bonded to a grid core of mechanically interlocking aluminum I-beams and shall be laminated under a controlled process of heat and pressure. Tape bond systems are not allowed.

2.2.4.2 Translucent sandwich panel deflection shall not exceed 3.5 inches at 35 pounds per square foot loading and shall not exceed .010-inch set deflection 5 minutes after load release per ASTM E72 with a 12-foot clear span, tested flat.

2.2.4.3 Grid pattern shall be as indicated.

2.2.4.4 The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge. In order to insure bonding strength, white spots at intersections of muntins and mullions shall not exceed 4 for each 40 square feet of panel, nor shall they be more than 3/64-inch in width.

2.2.4.5 Skylight panels and aluminum perimeter frame shall be preassembled where practical and sealed at the factory. Panels should be shipped to the jobsite in rugged shipping units and shall be ready for erection.

2.2.5 Battens and Perimeter Closure Systems: Extruded 6063-T6 and 6063-T5 aluminum screw clamp-tite closure system.

2.2.5.1 Aluminum closures to be supplied with 300 series stainless-steel screws (excluding final fasteners to the building) and shall be factory-sealed to the panels. Aluminum battens and cap plates shall be field-installed.

2.2.5.2 All exposed aluminum to be standard aluminum mill finish (clear anodized aluminum).

2.2.6 Flexible Sealing Tape: Sealing tape shall be manufacturer's standard preapplied to closure system at the factory under controlled conditions.

PART 3 EXECUTION

3.1 GENERAL: The Contractor install a skylight system as indicated on the plans and specified herein.

3.2 PREPARATION: The Contractor shall prepare openings including isolating dissimilar materials from aluminum system which may cause damage by electrolysis.

3.3 INSTALLATION: Install translucent skylight system in accordance with the manufacturer's written installation instructions including any shop drawings supplied by manufacturer. Fastening and sealing shall be in accordance with manufacturer's written installation instructions. All aluminum shall be cleaned before sealants are applied. After other trades have completed work on adjacent material, carefully inspect translucent panel installation and make adjustments necessary to insure proper installation and weathertight conditions.

3.4 CLEANING AND PROTECTION: Clean exposed metal and plastic surfaces in accordance with manufacturer's instructions. Touch-up damaged metal coatings. Clean and polish skylight units, inside and out, not more than 5 days prior to date of final inspection.

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07920

CALKING AND SEALANT

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of calking and sealant required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

C834	Latex Sealing Compounds.
C920	Elastomeric Joint Sealants.

1.2.2 Federal Specifications (FS):

TT-S-227	Sealing Compound: Elastomeric Type, Multi-Component (For Calking, Sealing, and Glazing in Buildings and Other Structures).
TT-S-230	Sealing Compound: Elastomeric Type, Single Component (For Calking, Sealing, and Glazing in Buildings and Other Structures).
TT-C-598	Calking Compound: Oil and Resin Base Type (For Building Construction).
TT-S-1543	Sealing Compound: Silicone Rubber Base (For Calking, Sealing, and Glazing in Buildings and Other Structures).
TT-S-1657	Sealing Compound: Single Component, Butyl Rubber Based, Solvent Release Type (For Buildings and Other Types of Construction).

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 BACKUP MATERIAL: Backup material shall be closed-cell resilient urethane, polyvinyl-chloride or polyethylene foam and recommended by the sealant manufacturer for use with the sealant specified.

2.3 BOND-PREVENTIVE MATERIAL: Bond-preventive material shall be polyethylene tape with pressure-sensitive adhesive and recommended by the sealant manufacturer for use with the sealant specified.

2.4 PRIMERS: Primers shall be applied with elastomeric sealant and be recommended by the sealant manufacturer for use with the sealant specified.

2.5 LATEX BASE CALKING COMPOUND: Latex base calking compound shall conform to ASTM C834.

2.6 OIL AND RESIN BASE CALKING COMPOUND: Oil and resin base calking compound shall conform to FS TT-C-598, Type I.

2.7 SINGLE COMPONENT BUTYL RUBBER: Single component butyl rubber base sealant shall conform to FS TT-S-1657, Type I or II.

2.8 SINGLE COMPONENT ELASTOMERIC: Single component elastomeric sealant shall conform to FS TT-S-230, Type II, Class A or B; and ASTM C920, Type S, Grade NS, Class 25, and suitable for the intended use.

2.9 SINGLE COMPONENT SILICONE RUBBER: Single component silicone rubber base sealant shall conform to FS TT-S-1543, Class A or B.

2.10 MULTICOMPONENT ELASTOMERIC: Multicomponent elastomeric sealant shall conform to FS TT-S-227, Type II, Class A or B; and ASTM C920, Type M, Grade NS, Class 25, and suitable for the intended use. The sealant shall be supplied in premeasured kit form for on-the-job mixing.

PART 3 EXECUTION

3.1 GENERAL: Install calking and sealant in the locations indicated on the plans.

3.2 PREPARATION: Prepare surfaces and joints to receive calking and sealant in accordance with the calking and sealant manufacturer's written installation instructions.

3.3 INSTALLATION: Install calking and sealant in accordance with the calking and sealant manufacturer's written installation instructions. Installation shall include backup material, bond preventive material, and primer as indicated on the plans, or required by the calking and sealant manufacturer's written installation instructions.

DIVISION 8 – DOORS AND WINDOWS

08110	Steel Doors and Steel Frames
08210	Wood Doors
08410	Aluminum Entrances and Storefronts
08520	Aluminum Windows
08700	Hardware
08810	Glass and Glazing

DIVISION 8 - DOORS AND WINDOWS

SECTION 08110

STEEL DOORS AND STEEL FRAMES

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of steel doors and steel frames required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Publications shall be assumed to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

C236	Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box.
E283	Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.

1.2.2 National Fire Protection Association (NFPA) Publications:

80	Fire Doors and Windows.
101	Code for Safety to Life from Fire in Buildings and Structures.

1.2.3 Steel Door Institute (SDI) Specification:

100	Standard Steel Doors and Frames.
105	Recommended Erection Instructions for Steel Frames.
113	Test Procedure and Acceptance Criteria For Apparent Thermal Performance of Steel Door and Frame Assemblies.
116	Standard Test Procedure and Acceptance Criteria for Rate of Air Flow Through Closed Steel Door and Frame Assemblies.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

1.3.3 Shop Drawings: The Contractor shall submit shop drawings of the proposed fabrication and installation of steel doors and steel frames. Shop drawings shall include elevations and sections, size and thickness of materials, fasteners and the method of anchoring, and the location of hardware and accessories.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 DOORS: Steel doors shall conform to SDI 100, Grade II - Heavy Duty. Steel doors shall be factory-primed, 18 gauge steel, and the thickness and size indicated on the Door Schedule. When used for exterior applications, steel doors shall be fully insulated.

2.3 DOOR FRAMES: Steel door frames shall conform to SDI 100. Steel door frames shall be factory-primed, 16 gauge steel, have rubber silencers, and be the size to fit the doors indicated on the Door Schedule. When used for exterior applications, steel door frames shall have compression type weatherstripping.

2.4 DOOR SYSTEMS: When steel doors and steel frames are supplied as a system for exterior applications, the door system shall meet or exceed the minimum performance standards set forth in SDI 113 and 116 when tested in accordance with ASTM C236 and E283.

2.5 FASTENERS: Fasteners for door and frame installation shall be cadmium or zinc plated steel, stainless steel, or other noncorrosive metal.

2.6 FIRE RATING: When indicated on the Door Schedule, steel doors and steel frames shall have the fire rating specified, and bear an Underwriter's Laboratories, Inc. or Factory Mutual, Inc. label certifying conformance with the applicable portions of NFPA 80 and 101.

2.7 GLAZING: When indicated on the Door Schedule, steel doors shall have glazing of the size and type specified, installed. Glazing shall be accomplished as specified in SECTION 08800, GLASS AND GLAZING.

2.8 HARDWARE: Steel doors shall be provided with the door hardware indicated on the Hardware Schedule. Hardware shall be as specified in SECTION 08700, HARDWARE.

2.9 LOUVERS: When indicated on the Door Schedule, steel doors shall have louvers of the size and type specified, installed. Louvers shall be as specified in SECTION 08700, HARDWARE.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install steel doors and steel frames as indicated on the plans and specified herein.

3.2 INSTALLATION: The installation of steel doors and steel frames shall be accomplished in accordance with SDI 105, the manufacturer's written installation instructions, and the Contractor's approved shop drawings.

DIVISION 8 - DOORS AND WINDOWS

SECTION 08210

WOOD DOORS

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of wood doors and steel frames required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

E283	Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
E331	Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
E437	Industrial Wire Cloth and Screens (Square Opening Series).
E547	Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.

1.2.4 National Fire Protection Association (NFPA) Publications:

80	Fire Doors and Windows.
101	Code for Safety to Life from Fire in Buildings and Structures.

1.2.5 National Wood Window and Door Association (NWWDA) Industry Standards:

I.S. 1	Wood Flush Doors.
I.S. 4	Water-Repellent Preservative Treatment for Millwork.
I.S. 6	Wood Stile and Rail Doors.
I.S. 610	Minimum Performance Standard for Air Infiltration Resistance of Exterior Wood Swinging Door Systems.
I.S. 620	Minimum Performance Standard for Water Penetration Resistance of Exterior Wood Swinging Door Systems.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.3 Shop Drawings: Submit shop drawings of the proposed fabrication and installation of wood doors and steel frames. Shop drawings shall include elevations and sections, size and thickness of materials, fasteners and the method of anchoring, and the location of hardware and accessories.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 GENERAL FABRICATION REQUIREMENTS:

2.2.1 Adhesives: Adhesives shall conform to NWWDA I.S. 1 Series; Type I Bond for exterior doors and Type II Bond for interior doors. All adhesives shall be nonstaining.

2.2.2 Edge Sealing: All wood end-grain exposed at edges of doors shall be sealed prior to shipment.

2.2.3 Preservative Treatment: Doors for exterior applications shall have both sides, all 4 edges, and penetrations for hardware waterproofed in accordance with NWWDA I.S. 4.

2.3 GRADES OF DOORS:

2.3.1 Doors to Receive a Natural Finish:

2.3.1.1 Hardwood Veneer Flush Doors: Grade 1, Book Matched.

2.3.1.2 Lauan Veneer Flush Doors: Grade AA.

2.3.1.3 Hardwood or Softwood Louvered and Paneled Doors: Premium or Select Grade.

2.3.2 Doors to Receive a Paint Finish:

2.3.2.1 Hardwood Veneer Flush Doors: Sound Grade.

2.3.2.2 Lauan Veneer Flush Doors: Grade BB-SP.

2.3.2.3 Hardwood or Softwood Louvered and Paneled Doors: Standard Grade.

2.4 DOORS:

2.4.1 Solid Core Wood Flush Doors: Solid core wood flush doors shall conform to FHDA 7, or NWWDA I.S. 1.1, 1.2 and 1.4 thru 1.7. Solid core doors shall be birch or oak veneer, 7-ply construction with glued wood block or cores, solid wood rails, stiles and lock blocks. Solid core doors shall be the thickness and size indicated on the Door Schedule.

2.4.2 Stile and Rail Doors: Stile and rail wood doors shall conform to NWWDA I.S. 6. Paneled doors shall be solid oak, with solid wood rails and stiles. Flat panels shall have a minimum finished panel thickness of 5/8 inch, and raised panels shall have a minimum finished panel thickness of 3/4 inch. Paneled doors shall be the thickness and size indicated on the Door Schedule.

2.5 FASTENERS: Fasteners for door and frame installation shall be cadmium or zinc plated steel, stainless steel, or other noncorrosive metal.

2.6 FIRE RATING: Wood doors shall have the fire rating indicated on the Door Schedule and bear an Underwriter's Laboratory, Inc. or Factory Mutual, Inc. label certifying conformance with the applicable portions of NFPA 80 and 101.

2.7 GLAZING: Wood doors shall be glazed as indicated on the Door Schedule. Glazing shall be accomplished as specified in SECTION 08800, GLASS AND GLAZING.

2.8 HARDWARE: Wood doors shall be provided with the door hardware indicated on the Hardware Schedule. Hardware shall be as specified in SECTION 08700, HARDWARE.

PART 3 EXECUTION

3.1 GENERAL: Install wood doors and steel frames as indicated on the plans and specified herein.

3.2 INSTALLATION: Install wood doors and steel frames in accordance with SDI 105, the manufacturer's written installation instructions, and the Contractor's approved shop drawings.

DIVISION 8 - DOORS AND WINDOWS

SECTION 08410

ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of aluminum entrances and storefronts required in this project. Included as a part of this work is glass and glazing and hardware.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 Architectural Aluminum Manufacturer's Association (AAMA) Publication:

602-2	Laboratory Qualifying Procedure for Temporary Clear Protective Coatings for Aluminum.

1.2.2 American National Standards Institute (ANSI) Publications:

A156.1	Butts and Hinges.
A156.3	Exit Devices.
A156.4	Door Controls - Closers.
A156.6	Architectural Door Trim.
A156.16	Auxiliary Hardware.
A156.21	Thresholds.
Z97.1	Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings.

1.2.3 American Society for Testing and Materials (ASTM) Publications:

B209/B209M	Aluminum and Aluminum-Alloy Sheet and Plate.
B221/B221M	Aluminum and Aluminum-Alloy Extruded Bar, Rod, Wire, Shape and Tube.
C1048	Heat Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
E283	Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
E330	Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
E331	Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

E547 Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.

E774 Sealed Insulating Glass Units.

1.2.4 American Welding Society (AWS) Publication:

D1.2 Structural Welding Code Aluminum.

1.2.5 Flat Glass Marketing Association (FGMA) Publication:

Glazing Manual.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: Submit samples of the proposed finish on the framing. Samples shall be manufacturer's standard size and shall exhibit range of variation in color to be expected.

1.3.3 Installation Instruction: Submit manufacturer's written installation instructions.

1.3.4 Shop Drawings: Submit shop drawings of the proposed fabrication and installation of aluminum entrances and storefronts. Shop drawings shall include elevations and sections, size and thickness of materials, fasteners and the method of anchoring, and the location of hardware and accessories.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ALUMINUM ENTRANCES AND STOREFRONTS:

2.2.1 General Design Requirements:

2.2.1.1 Loading: Fabricate components from manufacturer's stock systems which have been tested in accordance with ASTM E330 to withstand at least the following loadings:

2.2.1.1.1 Uniform wind pressure of 25 psf inward and 25 psf outward.

2.2.1.1.2 Uniform roof-loading of 30 psf (live) and 15 psf (dead) - total load of 45 pounds per square foot of roof area transferred to vertical mullions. Contractor shall furnish framing properly reinforced to withstand these loads whether specified or not.

2.2.1.2 Air and Water Leakages: Air infiltration of not more than 0.06 CFM per square foot of fixed area per ASTM E283 and no uncontrolled water penetration per ASTM E331 or E547 at pressure differential of 6.24 psf (excluding operable door edges).

2.2.1.3 Field Measurement: Wherever possible, take field measurements prior to preparation of shop drawings and fabrication, to ensure proper fitting of

work. However, proceed with fabrication and coordinate installation tolerances as necessary when field measurements delay work.

2.2.2 Aluminum Framing Materials and Accessories:

2.2.2.1 Aluminum Members: Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish; ASTM B221 for extrusions, ASTM B209 for sheet/plate.

2.2.2.2 Fasteners: Aluminum, non-magnetic stainless steel, or other materials warranted by the manufacturer to be noncorrosive and compatible with aluminum components. Do not use exposed fasteners except where unavoidable for application of hardware. Match finish of adjoining metal. Provide Phillips flat-head machine screws for exposed fasteners.

2.2.2.3 Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible; otherwise, nonmagnetic stainless steel or hot-dip galvanized steel.

2.2.2.4 Clear Protective Coatings: AAMA 602.2, compounded specifically for protection of aluminum finish during construction.

2.2.2.5 Sliding Weatherstripping: Manufacturer's standard replaceable stripping of wool, polypropylene, or nylon woven pile, with nylon fabric and aluminum strip backing.

2.2.2.6 Finish: Anodized - AA M21C22A42 #40 Dark Bronze.

2.2.3 Fabrication:

2.2.3.1 General: Details shown are based upon standard details by manufacturer indicated. Similar details by other manufacturer's listed will be acceptable, provided they comply with other requirements, including profile limitations.

2.2.3.2 Prefabrication: To greatest extent possible, complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site. Disassemble components only as necessary for shipment and installation. Do not drill and tap for surface-mounted hardware items until time or installation at project site.

2.2.3.3 Sequence: Complete cutting, fitting, forming, drilling, and grinding of metal work prior to cleaning, finishing, surface treatment, and application of finishes. Remove arises from cut edges and ease edges and corners to radius of approximately 1/64-inch.

2.2.3.4 Welding: Comply with AWS D1.2 to avoid discoloration; grind exposed welds smooth and restore mechanical finish.

2.2.3.5 Reinforcing: Install steel reinforcing as necessary to carry roof and wind loading; separate dissimilar metals with bituminous paint or other separator which will prevent corrosion.

2.2.3.6 Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.

2.2.3.7 Fasteners: Conceal fasteners wherever possible.

2.2.3.8 Weatherstripping: Provide compression weatherstripping against fixed stops and door bottom weatherstripping on each door.

2.2.3.9 Storefront Framing System: Inside-outside matched resilient flush-glazed system, fabricated for stick-type erection procedure with provision for glass replacement. Thermally broken type equal to one of the following: Kawneer 1600 Curtainwall; Vistawall HP 225 Thermal Wall System.

2.2.3.10 Aluminum Doors: Provide tubular frame members, fabricated with mechanical joints using heavy inserted reinforcing plates and concealed tie-rods or j-bolts, or fabricate with structurally welded joints, at manufacturer's option. Provide doors 1-3/4 inch thick, medium stile 3-1/2 inch wide edge and top stile, 6-1/2 inch bottom stile.

2.3 HARDWARE: Provide door hardware as indicated in Section 08700.

2.4 GLASS:

2.4.1 Tempered Glass: Where required by ANSI Z97.1 or where shown on the drawing, provide tempered safety glass conforming to ASTM C1048, Kind FT, Condition A, Type I, Class I, 1/4 inch Solar bronze.

2.4.2 Insulating Glass: Insulating glass shall conform to ASTM E774. Provide two sheets of glass as follows, and dry air or gas-filled space with -20 degrees F dew point, with Class A sealant-type edge construction to maintain a hermetic seal. Use tempered glass where "Safety Insulating Glass" is required by ANSI Z97.1.

2.4.2.1 1-Inch Insulating Glass (Storefront):

Outside Sheet: 1/4-inch solar bronze
Air Space: 1/2-inch
Inside Sheet: 1/4-inch clear

2.4.2.2 Edge Construction: Fabricators option to maintain product warranty.

2.4.2.3 Warranty: Provide manufacturer's standard 5-year product warranty on maintained hermetic seal.

2.4.2.4 Installation: Conform to FGMA Glazing Manual.

2.4.3 Miscellaneous Glazing Materials:

2.4.3.1 Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

2.4.3.2 Setting Blocks: Neoprene or EPDM, 70-90 durometer hardness, with proven compatibility with sealants used.

2.4.3.3 Spacers: Neoprene or EPDM, 40-50 durometer hardness, with proven compatibility with sealants used.

2.4.3.4 Cellular Neoprene Glazing Gaskets: Extruded/molded, closed-cell, integral-skinned neoprene of profile required to maintain watertight seal.

2.4.3.5 Vinyl Foam Glazing Tape: Closed cell, flexible, self-adhesive, non-extruding, polyvinyl chloride foam tape; recommended by manufacturer for exterior, exposed, watertight installation of glass, with only nominal pressure in the glazing channel.

PART 3 EXECUTION

3.1 GENERAL: Install aluminum entrance doors and storefront windows as indicated on the plans and specified herein.

3.2 INSTALLATION OF ENTRANCES AND STOREFRONTS:

3.2.1 General: Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Anchor securely in place, separating aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.2.2 Hardware: Drill and tap frames an doors and apply surface-mounted hardware items, complying with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.

3.2.3 Calking and Sealing: Set sill members and other members in bed of compound as shown, or with joint fillers or gaskets as shown to provide weathertight construction. Comply with requirements of SECTION 07920, CALKING AND SEALANTS.

3.3 INSTALLATION OF GLASS:

3.3.1 General: Watertight and airtight installation of each glass product is required. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.

3.3.2 Glazing:

3.3.2.1 Install setting blocks of proper size in sill rabbet, located 1/4th of glass width from each corner.

3.3.2.2 Provide spacers inside and out, of proper size and spacing, for glass sizes larger than 50 united inches, except where gaskets or preshimmed tapes are used for glazing. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.

3.3.2.3 Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

3.3.2.4 Clean and trim excess glazing materials from glass and stops or frames promptly after installation, and eliminate stains and discolorations.

3.3.2.5 Miter cut and bond ends together at corners where gaskets are used for channel glazing, so that gaskets will not pull away from corners and result in voids or leaks in glazing system.

3.4 ADJUST AND CLEAN:

3.4.1 Adjust Operating Hardware: Adjust hardware to function properly, without binding, and to provide tight fit at contact points and weatherstripping.

3.4.2 Clean Completed System: Clean completed system inside and out, promptly after erection and installation of glass and sealants. Remove excess glazing and sealant compounds, dirt, and other substances from aluminum surfaces.

3.4.3 Institute Protective Measures: Institute protective measures and other precautions required to assure that aluminum entrances and storefronts and glazing will be without damage or deterioration, other than normal weathering, at time of acceptance.

3.4.4 Wash and Polish Glass: Wash and polish glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Comply with glass product manufacturer's recommendations for final cleaning.

DIVISION 8 - DOORS AND WINDOWS

SECTION 08520

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of aluminum windows required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 Aluminum Association (AA) Publication:

45	Designation System for Aluminum Finishes.

1.2.2 American Architectural Manufacturers Association (AAMA) Publications:

603.8	Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
608.1	Voluntary Guide Specification and Inspection Methods For Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
1503.1	Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

1.2.3 American Architectural Manufacturers Association/National Wood Window and Door Association (AAMA/NWWDA) Publication:

101/I.S. 2	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.

1.2.4 American Society for Testing and Materials (ASTM) Publications:

C236	Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box.
E283	Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
E330	Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
E331	Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
E547	Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.3 Shop Drawings: Submit shop drawings of the proposed fabrication, installation, and glazing of aluminum windows. Shop drawings shall include elevations and sections, size and thickness of materials and fasteners, and the method of anchoring.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ALUMINUM WINDOWS: Aluminum windows shall conform to AAMA/NWWDA 101/I.S. 2 and the requirements herein. Aluminum windows shall meet or exceed the minimum Gateway Performance Requirements for **SPECIFY CLASS AND GRADE REQUIRED** C-30 (Commercial-30 psf), as set forth in AAMA/NWWDA 101/I.S. 2 when tested in accordance with ASTM C236, E283, E330, and E331 or 547. Windows shall be glazed as specified and have a minimum condensation resistance factor (crf) of 50 when tested in accordance with AAMA 1503.1. Window frames and sashes shall have effective thermal breaks to prevent condensation on the inside of the windows. Operating window sashes shall have underscreen operators and be completely weatherstripped. Windows shall have a mill finish or an anodized finish conforming to AAMA 608.1; AA-M12C22A32 or AA-M12C22A34, Class I, Dark Bronze, as specified in AA 45. Windows shall be complete units with all hardware necessary for complete installation. Aluminum windows shall be the type and size indicated on the Window Schedule.

2.3 FASTENERS: Fasteners for window construction and installation shall be aluminum alloy, cadmium or zinc plated steel, stainless steel, or other non-corrosive metal compatible with aluminum.

2.4 GLASS: Aluminum windows shall be factory-glazed with the glass indicated on the Window Schedule. Glazing shall be as specified in SECTION 08800, GLASS AND GLAZING.

PART 3 EXECUTION

3.1 GENERAL: Install aluminum windows as indicated on the plans and specified herein.

3.2 INSTALLATION: Install aluminum windows in accordance with the applicable portions of AAMA/NWWDA 101/I.S. 2, the window manufacturer's written installation instructions, the Contractor's approved shop drawings. Glass shall have labels removed and be spotlessly clean upon completion of the installation.

DIVISION 8 - DOORS AND WINDOWS

SECTION 08700

HARDWARE

PART 1 GENERAL

1.1 SCOPE: work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of hardware required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standards:

A156.1	Butts and Hinges.
A156.2	Bored and Preassembled Locks and Latches.
A156.3	Exit Devices.
A156.4	Door Controls - Closers.
A156.5	Auxiliary Locks and Associated Products.
A156.6	Architectural Door Trim.
A156.7	Template Hinge Dimensions.
A156.9	Cabinet Hardware.
A156.11	Cabinet Locks.
A156.16	Auxiliary Hardware.
A156.18	Materials and Finishes.
A156.19	Power Assist and Low-Energy Power-Operating Doors.
A156.21	Thresholds.

1.2.2 Builders' Hardware Manufacturer's Association (BHMA) Publications:

Directory of Certified Locks and Latches.

Directory of Certified Door Closers.

1.2.3 Door and Hardware Institute (DHI) Publications:

Keying - Procedures, Systems and Nomenclature.

Recommended Locations for Builders' Hardware.

The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builders' Hardware.

1.2.4 National Fire Protection Association (NFPA) Publications:

80	Standard for Fire Doors and Windows.
101	Code for Safety to Life from Fire in Buildings and Structures.

1.2.5 Underwriters' Laboratories (UL) Publication:

228	Door Closer-Holders, With or Without Integral Smoke Detectors.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.3 Keying Schedule: Prepare a Keying Schedule in accordance with DHI Publication, "Keying - Procedures, Systems, and Nomenclature", and submit it for approval prior to installation of any locks. Upon completion of all work in this project, submit a Final Keying Schedule indicating the key combinations utilized in the project, and all possible reserve key combinations remaining.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified. Hardware materials and finishes shall be those specified, and conform to ANSI A156.18.

2.2 AUXILIARY HARDWARE: Auxiliary hardware shall conform to ANSI A156.16, and be the type and finish indicated in the Hardware Sets.

2.2.1 Stops: Wall type bumper with convex pad L02101. Dome type floor stop for doors without threshold L02141 or for doors with threshold L02161. Stops shall be wall type where possible; where not possible, furnish floor type or overhead type as required. Wall type with holder and keeper L01341 as indicated in the Hardware Sets.

2.2.2 Lever Extension Flush Bolt: Unlabled L04081 or fire labled L04201.

2.2.3 Dust Proof Strike: L04021.

2.3 AUXILIARY LOCKS: Auxiliary locks and associated products shall conform to ANSI A156.5, and be the type and finish indicated in the Hardware Sets.

2.3.1 Bored Deadbolts: Arrow: E Series. **Best Access Systems:** T Series. Lock cores shall conform to paragraph 2.13.1 below.

2.4 BUTTS AND HINGES: Butts and hinges shall conform to ANSI A156.1. Hinges for metal doors and frames shall also conform to ANSI A156.7. Butts and hinges shall be type, size, and finish indicated on the Hardware Schedule.

2.4.1 Continuous Hinges: Continuous hinges shall be manufacturer's standard full mortised, heavy duty, extruded aluminum, geared hinge. Continuous hinges shall meet or exceed ANSI/BHMA Grade 1.

2.5 CABINET HARDWARE: Cabinet hardware shall conform to ANSI A156.9, and be the type and finish indicated in the Hardware Sets.

2.6 CABINET LOCKS: Cabinet locks shall conform to ANSI A156.11, and be the type and finish indicated in the Hardware Sets.

2.7 DOOR CLOSERS: Door closing devices shall conform to ANSI A156.4, and be the type and finish indicated on the Hardware Schedule. All door closers shall be listed in the current BHMA Directory of Certified Door Closers.

2.8 DOOR TRIM: Door trim shall conform to ANSI A156.6, and be the type and finish indicated in the Hardware Sets.

2.8.1 Push Plate: Type J304, 4" x 16", finish indicated in Hardware Sets.

2.8.2 Door Pulls: Type J401, (1" x 10") finish indicated in Hardware Sets.

2.8.3 Kick Plates: Type J102, 0.050 inch thick. Width of plates shall be 2 inches less than door width for single doors and 1 inch less for pairs of doors. Height shall be 10 inches, except where the bottom rail is less than 10 inches the plate shall extend to within 1/2 inch of the panel mold or glass bead. Edges of plates shall be beveled.

2.8.4 Armor Plates: Type J101, 0.050 inch thick satin stainless steel, width of plates shall be 1 inch less than door width and height shall be 42 inches.

2.11 EXIT DEVICES: Exit devices shall conform to ANSI A156.3, and be the type, function, and finish indicated in the Hardware Sets.

2.12 LOCKS AND LATCHES: Bored and preassembled locks and latches shall conform to ANSI A156.2, Series 4000. Mortise locks and latches shall conform to ANSI A156.13, Series 1000. All locks and latches shall be listed in the current BHMA Directory of Certified Locks and Latches. Locks and latches shall be the series, grade, function, door thickness, backset, and finish indicated in the Hardware Sets.

2.12.1 Lock Cores:

Arrow: Lock cores shall be Arrow and precision solid brass with 7 nickel/silver pins and paracentric 2C keyways. Cores shall be easily removable and interchangeable. Furnish each core with 4 keys.

Best Access Systems: Lock cores shall be Best and precision solid brass with 7 nickel/silver pins and paracentric KABA-PEAKS-B2 keyways. Cores shall be easily removable and interchangeable. Furnish each core with 4 keys.

2.12.2 Latchsets: Latchsets shall be furnished complete with knobs or levers, roses, rose liners, rose thimbles, latch units, strikes, and fasteners.

Arrow: Latchsets shall be Arrow, Sierra SR Design (Levers), as indicated.

Best Access Systems: Latchsets shall be Best, Series 9K (Grade 1 Levers), or Series 7K (Grade 2 Levers), Style 15 Levers and Style C Trim, as indicated.

2.12.3 Locksets: Locksets shall be furnished complete with levers, roses, rose liners, rose thimbles, latch units with auxiliary latches, strikes, fas-

teners, and keys. Locksets shall have interchangeable lock cores as specified above.

Arrow: Locksets shall be Arrow, Series H (Grade 1) or Series M (Grade 2), with Sierra SR Design (Levers), as indicated.

Best Access Systems: Locksets shall be Best, Series 9K (Grade 1 Levers), or Series 7K (Grade 2 Levers), or Style 15 Levers and Style C Trim, as indicated.

2.13 LOUVERS: Louvers shall be fabricated from aluminum, galvanized steel, or stainless steel, and have a factory-primed finish. Louvers shall be nonremovable from the outside of exterior doors, or the secure side of interior doors. Louvers for interior doors shall be sightproof. Louvers for exterior doors shall be weatherproof, and have removable insect screens made from 18 by 16 aluminum mesh screening. Louvers shall be the sizes indicated on the Door Schedule.

2.14 POWER ASSIST AND LOW-ENERGY POWER-OPERATED DOORS: Power assist and low-energy power-operated doors shall conform to ANSI A156.19, and be the type, size, material, and finish indicated in the Door Schedule and Hardware Sets.

2.15 THRESHOLDS AND PERIMETER SEALS: Thresholds and perimeter seals shall conform to ANSI A156.3, A156.4 or A156.21 as appropriate, and be the type, size and finish indicated in the Hardware Sets.

2.15.1 Drip Caps: Extruded aluminum, 2-1/2 inch projection, 1-1/2 inches high, equal to Hager 810SD, Pemko 346D, or Reese R201DUR.

2.15.2 Gasketing: Ribbed sponge neoprene, 1/2 by 1/4 inch, self-adhesive, equal to Hager 726, Pemko S88, or Reese 797.

2.15.3 Sill Protection: Extruded aluminum, 1-1/4 by 1/4 inch retainer, 1-1/4 by 1/8 inch neoprene seal, equal to Hager 750SDN, Pemko 315DN, or Reese 323DUR.

2.15.4 Thresholds: Extruded aluminum J32100 (5″ wide) or J38130 as indicated, with finish as indicated in Hardwaare Sets. Provide manufacturer’s end closure pieces as needed.

2.15.5 Weatherstripping, Hardware Compatible: Extruded aluminum, 1-1/2 by 1/4 inch, black polyurethane seal, equal to Hager 881SDS, Pemko 290DS, or Reese 775DUR. Provide quantity for head and both jambs.

2.15.6 Silencers: Type L03011.

2.15.7 Astragals: Meeting stile, surface mounted, adjustable type with two piece extruded aluminum, 9/16″ x 1″ retainer and pile seal, equal to Pemko 351DP and 351D, Hager 8455D and 8465D, or NGP 140 PDKB and 140 KB.

2.16 HARDWARE FOR FIRE RATED DOORS: When indicated on the Door and Hardware Schedule, hardware for fire rated doors shall bear an Underwriters' Laboratories, Inc. or Factory Mutual, Inc. label certifying conformance with the applicable portions of NFPA 80 and 101.

PART 3 EXECUTION

3.1 GENERAL: Install hardware as indicated on the plans and specified herein.

3.2 INSTALLATION: Install hardware in accordance with the hardware manufacturer's written installation instructions, and DHI Publications: "Recommended Locations for Builders Hardware," and "The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builders' Hardware".

3.3 KEYING: Unless otherwise specified, locks installed by the Contractor shall be keyed to be consistent with one of Fort Riley's previously established masterkey systems. Keying information will be provided to the Contractor by the Public Works Locksmith, Building 374.

3.4 KEYS: Provide 4 keys for each lock installed. Provide 6 copies of each master key. Turn in all keys to the COR. Stamp master keys with the inscription, "U.S. Property, Do Not Duplicate". Catalog all keys turned in to the COR in accordance with DHI Publication, "Keying - Procedures, Systems and Nomenclature."

3.5 TURN IN OF OLD LOCKSETS: Turn in all old locksets, mortise locks, keys, and hardware to the PW Locksmith, where applicable.

3.6 HARDWARE SETS:

3.6.1 Hardware Sets For Building 446:

Set 1 Secondary Entry Door B03.2, B09.2 each to have:

1 set Weatherstripping

Set 2 Secondary Entry Doors B01.1, B03.1, B09.1, 104.1, 104.2, 107.3, 108.3, each to have:

1 ea Continuous Hinge, 710
1 ea Exit Device, Type 4, Modern, Function 08, Grade 1, 630
1 ea Closer, C02021, 630
1 ea Drip Cap, Para 2.15.1 (Doors 104.1, 104.2, 107.3, 108.3)
1 ea Sill Protection, Para 2.15.3
1 ea Threshold, J32100 (Doors B03.1, B09.1, 107.3, 108.3), J38130 (Doors B01.1, 104.1, 104.2), 719
1 set Weatherstripping, Para 2.15.5
1 ea Dustproof Strike, L04021, 630

Set 3 Main Entry Doors (Pairs) 101.1, 101.2 each to have:

2 ea Continuous Hinges, 710
2 ea Exit Device, Type 7, Modern, Function 04, Grade 1, 630
1 ea Closers, C02021, 630 (PT 4G)
1 ea Power Door Operator with Wireless Remote Activator
2 ea Kick Plate, J102, 630
2 ea Sill Protection, Para 2.15.3
1 ea Threshold, J38130, 710
1 set Weatherstripping, Para 2.15.5
1 ea Astragal, Para 2.15.7

Set 4 Main Entry Doors (Pairs) 102.1, 102.2 each to have:

2 ea Continuous Hinge, 710
1 ea Closer, C02021, 630 (PT 4G)
1 ea Power Door Operator with Wireless Remote Activator
2 ea Kick Plate, J102, 630
2 ea Push Plate, J304, 630
2 ea Pull, J401, 630
2 ea Silencers, Para 2.15.6

Set 5 Chair/Table Storage Room Doors (Pairs) 115.1 each to have:

3 pr	Butts, A8112, 4-1/2" x 4-1/2", 652
1 ea	Bored Lockset, F86, 652
2 ea	Lever Extension Flush Bolt, L04201, 652
1 ea	Dust Proof Strike, L04021, 630
2 ea	Wall Stop, L02101, 652
2 ea	Silencers, Para 2.15.6

Set 6 Janitor Closet, Beverage and Ware's Storage and Machine Room Doors B02.1, B14.1, 109.6, 109.8, 119.1 each to have:

1-1/2 pr	Butts, A8112, 4-1/2" x 4-1/2", 652
1 ea	Bored Lockset, F86, 652
1 ea	Kick Plate, J102, 630
1 set	Gasketing, Para 2.15.2

Set 7 General and Dry/Paper Storage and A/V Tech Room Doors B05.1, B08.1, 107.5, 107.6, 107.7, 107.8, 108.5, 108.6, 108.7, 108.8, 109.4, 114.1, 118.4, 118.5 each to have:

1-1/2 pr	Butts, A8112, 4-1/2″ x 4-1/2″, 652
1 ea	Bored Latchset, F75, 652
1 ea	Bored Deadbolt, E0151, 652
1 ea	Kick Plate, J102, 630
1 ea	Wall Stop, L02101, 652
3 ea	Silencers, Para 2.15.6

Set 8 Public Restroom Doors B06.1, B07.1, 116.1, 117.1 each to have:

1-1/2 pr	Butts, A8112, 4-1/2" x 4-1/2", 652
1 ea	Bored Deadbolt, E0151, 652
1 ea	Push Plate, J304, 630
1 ea	Door Pull, J401, 630
1 ea	Closer, C02011, 652
1 ea	Kick Plate, J102, 630
1 ea	Wall Stop, L02101, 652
3 ea	Silencers, Para 2.15.6

Set 9 Meeting and Ballroom Doors (Pairs) 107.1, 107.4, 108.1, 108.4 each to have:

3 pr	Butts, A8112, 4-1/2" x 4-1/2", 652
2 ea	Exit Device, Type 7, Modern, Function 08, Grade 1, 652
2 ea	Closer, C02021, 652 (PT 4G, Doors 107.4, 108.4)
2 ea	Kick Plate, J102, 630
2 ea	Wall Stop, L02101; 652 (Doors 107.1, 108.1)
2 ea	Silencers, Para 2.15.6
2 ea	Dustproof Strike, L04021, 630

Set 10 Meeting and Conference Room Doors B03.3, B09.3, 118.1, 118.2, 107.2, 108.2 each to have:

1-1/2 pr	Butts, A8112, 4-1/2" x 4-1/2", 652
1 ea	Exit Device, Type 4, Modern, Function 08, 652
1 ea	Closer, C02021, 652 (PT 4G, Doors 107.2, 108.2)
1 ea	Kick Plate, J102, 630
1 ea	Wall Stop, L02101, 652 (Doors B03.3, B09.3, 118.1, 118.2)
3 ea	Silencers, Para 2.15.6

Set 11 Office Doors 109.7, 111.1, 112.1, 113.1 each to have:

1-1/2 pr	Butts, A8112, 4-1/2" x 4-1/2", 652
1 ea	Bored Lockset, F82, 652
1 ea	Wall Stop, L02101, 652
3 ea	Gasketing, Para 2.15.2

Set 12 Corridor Door (Pairs) 105.1, 105.2 each to have:

3 pr	Butts, A8112, 4-1/2" x 4-1/2", 652
2 ea	Pull, J401, 652
2 ea	Electric Hold Open (refer to Electrical)

Set 13 Waiter’s Station Doors (Pairs) 109.1, 109.2 each to have:

3 pr	Butts, A8112, 4-1/2" x 4-1/2", 652
1 ea	Bored Deadbolt, E0151, 652
2 ea	Closer, C02101, 652
2 ea	Door Pulls, J401, 630
2 ea	Push Plate, J304, 630
2 ea	Armor Plate, J101, 630
2 ea	Lever Extension Flush Bolt, L04201, 652
2 ea	Dustproof Strike, L04021, 630

Set 14 Mechanical Room Door B094 to have:

1-1/2 pr	Butts, A8112, 4-1/2" x 4-1/2", 652
1 ea	Bored Lockset, F86, 652
1 ea	Closer, C02101, 652
1 ea	Sill Protection, Para 2.15.3
1 ea	Threshold, J38180, 719
1 set	Weatherstripping, Para 2.15.5

Set 15 Receiving Doors (Pair) 109.3 to have:

3 pr	Butts, A5112, 4-1/2" x 4-1/2", 630
1 ea	Bored Latchset, F81, 630
2 ea	Lever Extension Flush Bolt, L04201, 630
1 ea	Dustproof Strike, L04021, 630
2 ea	Closer, C02021, (PT 8C), 630
2 ea	Wall Stop, L01341, 630
1 set	Weatherstripping, Para 2.15.5
1 ea	Astragal, Para 2.15.7
1 ea	Threshold, J32100, 719

Set 16 Restroom Door 109.5 to have:

1-1/2 pr	Butts, A8112, 652
1 ea	Bored Lockset, F76, 652
3 ea	Silencers

Set 17 Corridor Doors (Pair) 106.1 to have:

3 pr	Butts, A8121, 4-1/2" x 4-1/2", 652
2 ea	Exit Device, Type 7, Modern, Function 08 (Lever) Grade 1, 652
2 ea	Closer, C02021, 652
2 ea	Silencers, Para 2.15.6
2 ea	Dustproof Strike, 630

Set 18 Cabinet Hardware for Coats B04 and B13:

20 ea	Drawer and Door Pulls, B02011
16 pr	Hinges, B01602
20 ea	Locks, E07282, 652
24 ea	Shelf Rests, B04013
4 pr	Drawer Slides, B05052

Set 19 Receiving Doors (Pair) 120.1 to have:

3 pr	Butts, A5112, 4-1/2" x 4-1/2", 630
1 ea	Exit Device, Type 4, Function 08 (Lever), Grade 1, 630
2 ea	Lever Extension Flush Bolt, L04201, 630
1 ea	Dustproof Strike, L04021, 630
2 ea	Closer, C02021, (PT 8C), 630
2 ea	Floor Stop, L02131, 630
1 set	Weatherstripping, Para 2.15.5

1 ea	Astragal, Para 2.15.7
1 ea	Threshold, J32100, 719

DIVISION 8 - DOORS AND WINDOWS

SECTION 08810

GLASS AND GLAZING

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of glass and glazing required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standard:

Z97.1	Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

C1036	Flat Glass.
C1048	Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
E774	Sealed Insulating Glass Units.

1.2.3 Flat Glass Marketing Association (FGMA) Publication:

Glazing Manual.

1.2.4 U.S. Department of Commerce Architectural and Transportation Barriers Compliance Board Publication:

16 CFR 1201	Safety Standard for Architectural Glazing Materials.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 GLASS:

2.2.1 Primary Glass: Primary glass shall conform to ASTM C1036, Type I, Class 1, Quality q3, and be the thickness and strength indicated on the plans, or match the glass being replaced. When glass thickness is not otherwise

specified, Single Strength or 3/32 inch thick glass shall be installed in openings up to and including 12 square feet; Double Strength or 1/8 inch thick glass shall be installed in openings over 12 square feet, but not over 18 square feet; 3/16 inch thick glass shall be installed in openings over 18 square feet, but not over 36 square feet; and 7/32 inch thick glass shall be installed in openings over 36 square feet, but not over 45 square feet; 1/4 inch thick glass shall be installed in openings over 45 square feet, but not over 54 square feet.

2.2.2 Tempered Safety Glass: Tempered safety glass shall conform to ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3, and be the thickness indicated on the plans, or match the glass being replaced. When tempered safety glass thickness is not otherwise specified, 1/8 inch thick glass shall be installed in openings up to and including 36 square feet; and 3/16 inch thick glass shall be installed in openings over 36 square feet, but not over 72 square feet. Glass installed in doors shall conform to the requirements set forth in ANSI Z97.1.

2.2.3 Insulating Glass: Insulating glass units shall conform to ASTM E774. Primary glass used to fabricate insulating glazing panels shall conform to ASTM C1036, Type I, Class 1, Quality q3, and be the thickness and strength indicated on the plans, or match the glass being replaced. Inner and outer lites shall be the same thickness and strength, and separated by a hermetically sealed, dehydrated 1/4 inch air space unless otherwise specified. When glass thickness is not otherwise specified, Single Strength or 3/32 inch thick glass shall be installed in openings up to and including 18 square feet; Double Strength or 1/8 inch thick glass shall be installed in openings over 18 square feet, but not over 27 square feet; and 3/16 inch thick glass shall be installed in openings over 27 square feet, but not over 54 square feet. Insulating glass installed in doors shall be tempered safety glass, and conform to ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3, and ANSI Z97.1.

2.3 GLAZING MATERIALS:

2.3.1 Compounds and Glazing Sealants: Glazing compounds or preformed glazing sealants shall be the proper product for the intended application, and conform to the applicable portions of the FGMA "Glazing Manual." Compounds shall match, or be painted to match, the frames. Preformed sealants shall match the frames and not require painting. Compounds and sealants shall be nonstaining.

2.3.2 Glazing Accessories: Glazing accessories shall be proper products for the intended application, and be aluminum alloy, cadmium or zinc plated steel, stainless steel or other noncorrosive metal.

2.3.3 Glazing Gaskets: EPDM exterior gaskets held in place by exterior pressure plates fastened to main grid members.

2.3.4 Setting Blocks: Neoprene or EPDM, 70-90 durometer hardness, with proven compatibility with sealants used.

2.3.5 Spacers: Neoprene or EPDM, 40-50 durometer hardness, with proven compatibility with sealants used.

2.3.6 Cleaners: Type recommended by glazing manufacturer.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall glaze the window and door openings as indicated on the plans and specified herein.

3.2 GLAZING: Glazing shall be accomplished in accordance with FGMA "Glazing Manual" and any applicable manufacturer's written installation instructions.

3.3 CLEANUP: Glass shall have labels removed and be spotlessly clean upon completion of the installation.

DIVISION 9 – FINISHES

09010	Finishes
09100	Metal Support Systems
09200	Lath and Plaster
09250	Gypsum Wallboard
09300	Ceramic Tile
09330	Quarry Tile
09510	Suspended Acoustical Ceilings
09660	Resilient Tile Flooring
09680	Carpeting
09725	Seamless Quartz Flooring
09835	Special Coating Multi-Color Wall Finish
09900	Painting, Staining and Varnishing

DIVISION 9 - FINISHES

SECTION 09010

FINISHES

PART 1 GENERAL

1.1 SCOPE: This section lists the color of finishes required in this project. The term “color” shall include pattern, texture and gloss.

1.2 APPLICABLE PUBLICATIONS: Not Used.

1.3 SUBMITTALS: Not Used.

PART 2 PRODUCTS

2.1 MATERIALS:

2.1.1 Colors indicated have been selected from the standard selection of the manufacturers shown. If other manufacturers are used, the color shall be selected by the Contracting Officer from the standard color charts of the manufacturer used.

2.1.2 Colors by manufacturers other than those indicated shall be custom matched to the specified color and submitted for approval to the Contracting Officer.

2.1.3 When a color is designated to match another color, the Contractor shall submit samples of the manufacturer’s standard colors to the Contracting Officer for selection.

2.2 RESILIENT FLOORING:

2.2.1 Vinyl Composition Tile: Tarkett; Expressions 2015 White/Taupe.

2.2.2 Rubber Base: Black

2.3 CARPET:

2.3.1 Carpet #1: J&J Commercial Carpet, Form (4640) Color, 720M, Harmony

2.3.2 Carpet #2: J&J Commercial Carpet, Function (4670) Color, 720M, Harmony

2.4 CERAMIC TILE:

2.4.1 Wall Tile #1: American Olean, 21 Bright Light Aspen

2.4.2 Wall Tile #2: American Olean, 159 Taupe Mist

2.4.3 Wall Tile #3: American Olean, 40 Storm Gray

2.4.4 Floor Tile #1: American Olean, AR23 Glacier Gray

2.4.5 Floor Tile #2: American Olean, AR24 Lichen Green

2.4.6 Grout: TEC, Light Pewter, 927

2.5 QUARRY TILE (Kitchen):

2.5.1 Quarry Tile Base: American Olean; 016 Gray Flash

2.5.2 Grout: TEC, Raven, 941

2.6 SEAMLESS QUARTZ FLOORING (Kitchen): Desco QB-13, Montery Brown, Quartzite Medium Texture

2.6 PLASTIC LAMINATE:

2.6.1 Countertops: Wilsonart, 4680-60, Lodestone

2.6.2 Cabinets: Pionite, WC421-S Oiled Cherry

2.7 TOILET PARTITIONS: Santana, 533 Topaz

2.8 CEILINGS:

2.8.1 Acoustical Ceiling Tile (Kitchen): Armstrong Clean Room VL, White

2.8.2 Acoustical Ceiling Tile (All Other Areas): Armstrong Dune, White

2.8.3 Metal Suspension System: White

2.9 INTERIOR SURFACES:

2.9.1 Paint – Accent @ Skylights: Sherwin Williams, SW1198, Blue Jade

2.9.2 Paint – Walls: Sherwin Williams, SW1029, Neutrino

2.9.3 Paint – Soffits: Sherwin Williams, SW1002, Big Chill

2.9.4 Paint – HM Door Frames: Sherwin Williams, SW

2.9.5 Special Coating #1 (First Floor): Polomyx, 4063-CP72

2.9.6 Special Coating #2 (Lower Level): Polomyx, 6004-FG52

2.9.7 Wood Base, Chair Rails & Doors: Sherwin Williams, SW3113, Cinnamon

2.9.8 Hollow Metal Door Frames: Sherwin Williams, SW1057, Uptown Taupe

2.10 OPERABLE WALLS:

2.10.1 Concourse Side: Panelfold, Formica, 1150-43 Vosges Pear, Matte Finish

2.10.2 Conference Room Side: Panelfold, Maharam Tek-Wall 1000, Sea Mist 165

2.11 WINDOW TREATMENT: Louver Drape, Levolor Home Fashions, Kismet, 94409, Parchment

2.12 INTERIOR SIGNAGE: ASI Sign Systems, SC523 Jade, White Letters/Braille

2.13 EXTERIOR SURFACES:

2.13.1 Exterior Waterproofing Finish System (EWFS): ChemRex, Thorolastic, Thoro Gray

2.13.2 Porte Cochere Fascia: Sherwin Williams, SW1287, Deep Maroon

2.13.3 Coping, Gutters, Downspouts & Flashings: Match existing dark bronze aluminum color.

2.13.4 Handrails, Guardrails, Metal Stairs and Misc. Metal Items: Match existing dark bronze aluminum color.

2.13.5 Aluminum Doors, Windows and Frames: Match existing dark bronze aluminum color.

2.13.6 Hollow Metal Doors & Frames: Match color of EWFS.

2.13.7 Precast Concrete Wall Panel Joint Sealant: Match color of EWFS.

PART 3 EXECUTION (NOT USED)

DIVISION 9 - FINISHES

SECTION 09100

METAL SUPPORT SYSTEMS

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of the metal support systems required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Iron and Steel Institute (AISI) Publication:

SG-673 Parts I-VII	Specification for the Design of Cold-Formed Steel Structural Members.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

A525	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
A527/A527M	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
C645	Nonload (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
C754	Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water Resistant Backing Board.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Shop Drawings: The Contractor shall submit shop drawings of the proposed fabrication, installation, connection, and accessories for cold-formed metal support systems.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 METAL SUPPORT SYSTEMS: Metal support system studs, joists, runners, furring channels, and bridging shall conform to AISI SG-673 and be the type, size, and gauge indicated on the plans. Nonload (axial) bearing studs, runners, and furring channels shall conform to ASTM C645, and be fabricated from galvanized steel which conforms to ASTM A525 and ASTM A527/A527M.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install all metal support systems indicated on the plans and specified herein.

3.2 ERECTION OF STRUCTURAL STEEL AND METAL FRAMING: Erection of metal support systems shall be accomplished in accordance with the applicable portions of ASTM C754 and the Contractor's approved shop drawings.

DIVISION 9 - FINISHES

SECTION 09200

LATH AND PLASTER

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the application of new lath and plaster and the patching of existing lath and plaster required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

C28	Gypsum Plasters.
C37	Gypsum Lath.
C588	Gypsum Base for Veneer Plasters.
C841	Installation of Interior Lathing and Furring.
C842	Application of Interior Gypsum Plaster.
C847	Metal Lath.
C1047	Accessories for Gypsum Wallboard and Gypsum Veneer Base.

1.2.2 U.S. Army Technical Manual (TM):

5-618	Paints and Protective Coatings.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Application and Finishing Instructions: The Contractor shall submit application and finishing instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 GYPSUM BASE: Gypsum base for veneer plaster shall conform to ASTM C588 and be the thickness which matches the existing.

2.3 GYPSUM LATH: Gypsum lath shall conform to ASTM C37 and be the thickness which matches the existing.

2.4 LIME, SAND AND WATER: Lime, sand and water shall be as recommended in ASTM C28 and the plaster manufacturer's written instructions.

2.5 PLASTER: Plaster shall be gypsum type and conform to ASTM C28.

2.6 METAL LATH: Metal lath shall be diamond mesh and conform to ASTM C847.

2.7 PLASTER ACCESSORIES: Casing beads, control joints, and other plaster accessories shall conform to ASTM C842 and C1047.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall apply new lath and plaster where indicated and patch all cracks, holes, and otherwise damaged or deteriorated lath and plaster surfaces.

3.2 PREPARATION: Surface preparation shall conform to the plaster manufacturer's written application and finishing instructions, and TM 5-618. Damaged lath shall be replaced.

3.3 APPLICATION: New lath and replacement lath shall be applied in accordance with ASTM C841, and the plaster manufacturer's written instructions. Gypsum plaster on lath shall be applied in 3 coats in accordance with ASTM C842, and the plaster manufacturer's written application and finishing instructions. Gypsum plaster may be applied directly on new masonry in a two coat application in accordance with ASTM C842, and the plaster manufacturer’s written application and finishing instructions.

3.3.1 Install cornerbeads at all external corners.

3.3.2 Install casing beads at termination of plaster work, except where plaster passes behind and is concealed by other work and where other trim acts as a casing bead.

3.3.3 Install control joints at spacing and locations required by referenced standard, recommended by plaster manufacturer and approved by the Contracting Officer. Secure approval of Contracting Officer prior to starting plastering operations. Spacing in joints in either direction shall not exceed 30 (thirty) feet.

3.3.4 Finished plaster surfaces shall not deviate more than plus or minus 1/8 inch in 10 (ten) feet from a true plane in finished plaster surface, as measured by a 10-foot straight edge placed at any location on the surface.

DIVISION 9 - FINISHES

SECTION 09250

GYPSUM WALLBOARD

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the application and finishing of gypsum wallboard required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

C36	Gypsum Wallboard.
C475	Joint Treatment Materials for Gypsum Wallboard Construction.
C514	Nails for Application of Gypsum Wallboard.
C557	Adhesives for Fastening Gypsum Wallboard to Wood Framing.
C840	Application and Finishing of Gypsum Board.
C954	Steel Drill Screws for the Application 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.
C1002	Steel Drill Screws for the Application of Gypsum Board.
C1047	Accessories for Gypsum Wallboard and Gypsum Veneer Base.

1.2.2 Gypsum Association:

GA 216	Recommended Specifications for the Application and Fastening of Gypsum Wallboard.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Application and Finishing Instructions: The Contractor shall submit application and finishing instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ACCESSORIES: Gypsum wallboard accessories shall conform to ASTM C1047.

2.3 ADHESIVE: Adhesive for application of gypsum wallboard shall conform to ASTM C557.

2.4 GYPSUM WALLBOARD: Tapered and fire-resistant gypsum wallboard shall conform to ASTM C36 and be the thickness indicated on the plans.

2.5 JOINT TREATMENT MATERIALS: Joint treatment materials shall conform to ASTM C475.

2.6 NAILS: Nails for application of gypsum wallboard shall conform to ASTM C514.

2.7 SCREWS: Screws for application of gypsum wallboard shall conform to ASTM C954 or C1002.

2.8 EXTERIOR GYPSUM SOFFIT BOARD: Tapered and fire-resistant gypsum soffit board shall conform to ASTM C36, be moisture and sag resistant and be the thickness indicated on the plans.

PART 3 EXECUTION

3.1 GENERAL: The contractor shall apply and finish gypsum wallboard as indicated on the plans and specified herein.

3.2 APPLICATION AND FINISHING: The application and finishing of gypsum wallboard shall conform to ASTM C840, GA 216, and the gypsum wallboard manufacturer's written application and finishing instructions. Joints between gypsum wallboard and lath and plaster shall be taped and finished as if they were conventional gypsum wallboard joints.

DIVISION 9 - FINISHES

SECTION 09300

CERAMIC TILE

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of ceramic tile required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 Federal Specification (FS):

TT-S-1543	Sealing Compound: Silicone Rubber Base (For Calking, Sealing, and Glazing in Buildings and Other Structures).

1.2.2 American National Standards Institute (ANSI) Standards:

A108.1	Installation of Ceramic Tile.
A137.1	Ceramic Tile.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: The Contractor shall submit color samples for selection of colors. Tile, trim, and accessories proposed for use in this contract shall be products which will be easily matched for future repairs.

1.3.3 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ADHESIVE:

2.2.1 Epoxy Adhesive: Epoxy adhesive shall conform to ANSI A108.1.

2.2.2 Organic Adhesive: Organic adhesive shall be waterproof and conform to ANSI A108.1.

2.3 CERAMIC TILE AND TRIM:

2.3.1 Ceramic Floor Tile: Ceramic floor tile shall conform to ANSI A137.1, be porcelain type, have cushion edges, and be suitable for mud or thin-set installations. Tiles shall be 12 by 12 by 1/4 inch thick as indicated on the

plans. Colors of tile shall be selected by the Contracting Officer from the samples provided by the Contractor.

2.3.2 Ceramic Wall Tile and Trim: Ceramic tile and trim components shall conform to ANSI A137.1, be porcelain type, have cushion edges, bright glaze, and be suitable for mud or thin-set installations. Tiles shall be 4 1/4 by 4 1/4 by 1/4 inch thick. Bull-nose shall be 6 by 4 1/4 by 1/4 inch. Bead shall be 6 by 3/4 by 1/4 inches. Cove base shall be 6 by 2 by 1/4 inches, 4 1/4 by 4 1/4 by 1/4 inches, or 6 by 4 1/4 by 1/4 inches. Stair nosings shall be 8 by 4 by ¼ inches. Colors of tile and trim shall be selected by the Contracting Officer from the samples provided by the Contractor.

2.4 CERAMIC TILE ACCESSORIES: Ceramic tile accessories shall conform to ANSI A137.1, be glazed porcelain the same color and finish as the wall tile and trim, and be suitable for mud or thin-set installation. Accessories shall be provided and installed as indicated on the plans.

2.5 GROUT:

2.5.1 Epoxy Grout: Epoxy grout shall conform to ANSI A108.1 and be the color selected by the Contracting Officer from the samples provided by the Contractor.

2.5.2 Portland Cement Grout: Portland cement grout shall conform to ANSI A108.1 and be the color selected by the Contracting Officer from the samples provided by the Contractor.

2.6 MORTAR:

2.6.1 Portland Cement Mortar: Portland cement mortar shall conform to ANSI A108.1 and the written recommendations of the tile manufacturer.

2.6.2 Dry-Set Portland Cement Mortar: Dry-set portland cement mortar and latex-portland cement mortar shall conform to ANSI A108.1.

2.7 SILICONE SEALANT: Silicone sealant shall be white and conform to FS TT-S-1543.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install ceramic tile, trim, and accessories as indicated on the plans and specified herein.

3.2 PREPARATION: Preparation of surfaces to receive ceramic tile, trim, and accessories shall be accomplished in accordance with ANSI A108.1.

3.3 INSTALLATION: Installation of ceramic tile, trim, and accessories shall be accomplished in accordance with ANSI A108.1 and any applicable manufacturer's written installation instructions. The joints between tubs, shower pans and tile, and penetrations in the tile for plumbing and kitchen equipment shall be neatly sealed with white silicone sealant.

3.4 CLEANING AND PROTECTING: Upon completion of the installation of tile, trim, accessories, and grout, all tile surfaces shall be cleaned in accordance with ANSI A108.1. After the grout has set, all tile surfaces shall be given a protective coat of waterproof grout sealer.

DIVISION 9 - FINISHES

SECTION 09330

QUARRY TILE

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of quarry tile required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standards:

A108.1	Installation of Ceramic Tile.
A137.1	Ceramic Tile.

1.2.2 Federal Specification (FS):

TT-S-1543	Sealing Compound: Silicone Rubber Base (For Calking, Sealing, and Glazing in Buildings and Other Structures).

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: The Contractor shall submit color samples for selection of colors. Tile and trim proposed for use in this contract shall be products which will be easily matched for future repairs.

1.3.3 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ADHESIVE:

2.2.1 Epoxy Adhesive: Epoxy adhesive shall conform to ANSI A108.1.

2.2.2 Organic Adhesive: Organic adhesive shall be waterproof and conform to ANSI A108.1.

2.3 GROUT:

2.3.1 Epoxy Grout: Epoxy grout shall conform to ANSI A108.1 and be the color selected by the Contracting Officer from the samples provided by the Contractor.

2.3.2 Portland Cement Grout: Portland cement grout shall conform to ANSI A108.1 and be the color selected by the Contracting Officer from the samples provided by the Contractor.

2.4 MORTAR:

2.4.1 Portland Cement Mortar: Portland cement mortar shall conform to ANSI A108.1 and the written recommendations of the tile manufacturer.

2.4.2 Dry-Set Portland Cement Mortar: Dry-set portland cement mortar and latex-portland cement mortar shall conform to ANSI A108.1.

2.5 QUARRY TILE AND TRIM: Quarry tile and trim shall conform to ANSI A137.1 and have a smooth unglazed finish. Tiles shall be 6 by 6 by 1/2 inch thick. Cove base shall be 5 by 6 by 1/2 inch thick. Colors of tile and trim shall be selected by the Contracting Officer from samples provided by the Contractor.

2.6 SILICONE SEALANT: Silicone sealant shall be clear and conform to FS TT-S-1543.

PART 3 EXECUTION

3.1 GENERAL: The contractor shall install quarry tile and trim as indicated on the plans and specified herein.

3.2 PREPARATION: Preparation of surfaces to receive quarry tile and trim shall be accomplished in accordance with ANSI A108.1.

3.3 INSTALLATION: Installation of quarry tile and trim shall be accomplished in accordance with ANSI A108.1 and any applicable manufacturer's written installation instructions. The joints between tile and penetrations in the tile for plumbing and kitchen equipment shall be neatly sealed with clear silicone sealant.

3.4 CLEANING AND PROTECTING: Upon completion of the installation of tile, trim, and grout, all tile surfaces shall be cleaned in accordance with ANSI A108.1. After the grout has set, all tile surfaces shall be given a protective coat of waterproof grout sealer.

DIVISION 9 - FINISHES

SECTION 09510

SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of suspended acoustical ceilings required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

C423	Sound Absorption and Sound Absorption Co-efficients by the Reverberation Room Method.
C635	Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
C636	Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
E84	Surface Burning Characteristics of Building Materials.
E413	Determination of Sound Transmission Class.

1.2.2 Federal Specification (FS):

SS-S-118	Sound Controlling Blocks and Boards (Acoustical Tiles and Panels, Prefabricated).

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ACOUSTICAL CEILING PANELS: Acoustical ceiling panels shall conform to FS SS-S-118. The acoustical panels shall have a Noise Reduction Coefficient (NCR) in the range of .50 to .60 when tested in accordance with ASTM C423, a Ceiling Sound Transmission Class (STC) in the range of 35 to 39 when tested in accordance with ASTM E413, and a Class A flame spread and smoke developed classification when tested in accordance with ASTM E84. Acoustical ceiling panels shall be lay-in type, 24 by 24 by 5/8 inch.

2.2.1 Food service areas shall have Armstrong Clean Room VL, non-perforated square, smooth texture panels with a factory-applied white vinyl-faced membrane, or an approved equal.

2.2.2 All other areas shall have Armstrong Dune, angled tegular, fine texture panels with a factory-applied white vinyl latex paint finish, or an approved equal.

2.3 METAL SUSPENSION SYSTEM: Metal suspension system for lay-in acoustical ceiling panels shall conform to ASTM C635. Metal suspension system shall be exposed grid type suspension system, 24 by 24 inch grid, double web with 15/16 inch face, intermediate duty, with a white enamel finish, or an approved equal.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install suspended acoustical ceiling systems as indicated on the plans and specified herein.

3.2 INSTALLATION: Installation of suspended acoustical ceiling systems shall conform to ASTM C636 and the manufacturer's written installation instructions. Coordinate installation with spray applied insulation installer. Spray applied insulation shall be installed after all hangars are attached but prior to the installation of the finished ceiling grid and tile.

3.3 EXTRA MATERIAL: The Contractor shall supply the Owner with a minimum of one full bundle of each type of ceiling tile.

DIVISION 9 - FINISHES

SECTION 09660

RESILIENT TILE FLOORING

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of resilient tile flooring required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standard:

A135.4	Basic Hardboard.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

E84	Surface Burning Characteristics of Burning Materials.
E648	Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
E662	Specific Optical Density of Smoke Generated by Solid Materials.

1.2.3 Federal Specifications (FS):

SS-W-40	Wallbase, Rubber, and Vinyl Plastic.
SS-T-312	Tile, Floor, Asphalt, Rubber, Vinyl, Vinyl-Asbestos.
RR-T-650	Treads, Metallic and Nonmetallic, Nonskid.

1.2.4 U.S. Department of Commerce Product Standards (PS):

PS 1	Construction and Industrial Plywood.
PS 58	Basic Hardboard.

1.2.5 Wood Moulding and Millwork Producers Association (WMMPA) Publications:

WM 4	Quality Standard for Wood Moulding.
WM 7	WM/Series Wood Moulding Patterns.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: The Contractor shall submit color samples for selection of colors.

1.3.3 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ADHESIVES: Adhesives for floor tile, stair treads, wallbase, and installation accessories shall be the type recommended by their manufacturer. All adhesives shall be waterproof.

2.2.1 Commercial Floor Tile Adhesives: Commercial floor tile adhesives for use on all types of approved subfloors shall be cut-back type Armstrong S-89 or S-90 Adhesives, or approved equals. Adhesive for use over existing resilient flooring shall be rubber-resin base type Armstrong S-139 Tile-On Adhesive, or an approved equal.

2.2.2 Wallbase Adhesive: Wallbase adhesive shall be solvent mastic base type Armstrong S-285 Wallbase Adhesive, or an approved equal.

2.3 FASTENERS: Fasteners for resilient flooring and accessories shall be the type recommended by their manufacturer. Fasteners shall be aluminum alloy, cadmium or zinc-plated steel, stainless steel, or other noncorrosive metal.

2.4 RESILIENT FLOORING ACCESSORIES: Resilient flooring installation accessories shall be products suitable for the purpose intended, and meet the standards recommended by the resilient flooring manufacturer. When applicable, installation accessories shall match the type, size, material, and finish of the existing accessories. Installation accessories shall include, but not be limited to, the following items: edging of all types, stair nosing, transition strips of all types, and other miscellaneous items necessary to make a complete installation.

2.5 RESILIENT FLOOR TILE: Resilient floor tile shall conform to FS SS-T-312, Type IV, Composition 1, and have a Class B flame spread and smoke developed classification when tested in accordance with ASTM E84 and ASTM E662. Resilient floor tile shall have an average minimum critical radiant flux of 0.45 watt per square centimeter or more when tested in accordance with ASTM E648. Floor tile shall be the type, size, gauge, texture, pattern, and color indicated below, or be selected by the Contracting Officer from the color samples provided by the Contractor.

2.5.1 Commercial Floor Tile:

HUD Pub or Fed Spec No	Type & Grade, Class or Composition	Size & Gauge or Thickness in Inches	Manufacturer	Texture, Pattern & Color
SS-T-312	Type IV Comp 1	12 x 12 1/8 Gauge	Armstrong or Approved Equal	Premium Excelon-Excelon Supreme 55502-Warm White
SS-T-312	Type IV Comp 1	12 x 12 1/8 Gauge	Tarkett or Approved Equal	Thru-Chip Series 3582-Greige/White/Brown

2.8 RUBBER WALLBASE: Rubber wall base shall conform to FS SS-W-40, Type II, Class 1 or 2. Wallbase shall be premolded rubber, .080 inch thick, and 4 inches high. Colors shall be selected by the Contracting Officer from the samples provided by the Contractor. Preformed corners in matching size, profile, and color shall be used for right-angle inside and outside corners.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install floor tile, wall base, and accessories as indicated on the plans and specified herein.

3.2 INSTALLATION: The installation of floor tile, floor underlayment, wall base, and accessories shall be accomplished in accordance with the manufacturer's written installation instructions. Installation shall include all resilient flooring installation accessories necessary to make a complete installation.

3.3 CLEANUP: Upon completion of the installation of tile, wall base, and accessories, all exposed surfaces shall be cleaned so they are free of adhesive smears, scuffs, and dirt.

3.4 EXTRA MATERIAL: The Contractor shall supply the Owner with a minimum of one full box of each color of floor tile.

DIVISION 9 - FINISHES

SECTION 09680

CARPETING

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of carpet pad and carpet required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Association of Textile Chemists and Colorists (AATCC) Publication:

Test Method 134	Electrostatic Propensity of Carpet.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

E84	Surface Burning Characteristics of Building Materials.
E648	Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
E662	Specific Optical Density of Smoke Generated by Solid Materials.

1.2.3 Federal Specifications (FS):

SS-W-40	Wallbase: Rubber and Vinyl Plastic.
DDD-C-95	Carpet and Rugs, Wood, Nylon, Acrylic, Mod-Acrylic, Polyester, Polypropylene.
ZZ-C-811	Cushion, Carpet and Rug, Cellular Rubber.
DDD-C-1023	Cushion, Carpet and Rug (Hair Felt and Rubber Coated Jute and Animal Hair or Fiber).
L-C-1676	Cushion, Carpet and Rug, Virgin Urethane.

1.2.4 Wood Moulding and Millwork Producers Association (WMMPA) Publications:

WM 4	Quality Standard for Wood Moulding.
WM 7	WM/Series Wood Moulding Patterns.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: The Contractor shall submit color samples for selection of colors.

1.3.3 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ADHESIVES AND FASTENERS: Adhesives and fasteners for carpet pad, carpet, wallbase, and installation accessories shall be the type recommended by the manufacturer. All adhesives shall be waterproof. Fasteners shall be aluminum alloy, cadmium or zinc-plated steel, stainless steel, or non-corrosive metal.

2.3 CARPET: Carpets shall conform to FS DDD-C-95. Carpet shall have a Class B flame spread and smoke developed classification when tested in accordance with ASTM E84 and ASTM E662 and an average minimum critical radiant flux of 0.45 watt per square centimeter or more when tested in accordance with ASTM E648. Static buildup shall be 3.5 kV or less when tested at 20 percent relative humidity and 70 degrees F. in accordance with AATCC Test Method 134. Color, texture, and pattern shall be selected by the Contracting Officer from the samples provided by the Contractor. The carpet shall have the physical characteristics listed below.

2.3.1 Commercial Carpet:

Name/ Const/ Type	Face Fiber	Gauge	Pile Hgt	Yarn Weight Per Sy	Primary Bckng
J&J Commercial Form (4640) ActionBac					
Patterned Cut & Loop	100% Dupont Type 6.6	1/8″	.252″	36.0 oz	Synth
J&J Commercial Function (4670) ActionBac					
Patterned Cut & Loop	100% Dupont Type 6.6	1/8″	.252″	36.0 oz	Synth

2.5 CARPET INSTALLATION ACCESSORIES: Carpet installation accessories including adhesive shall be products suitable for the purpose intended and meet the standards recommended by the carpet manufacturer. When applicable, installation accessories shall match the type, size, material, and finish of the existing accessories. Installation accessories shall include, but not be limited to, the following items: tack strips, edging of all types, transition strips of all types, and other miscellaneous items necessary to make a complete installation.

2.6 RUBBER WALLBASE: Rubber wallbase shall conform to FS SS-W-40, Type II, Class 1 or 2. Wallbase shall be premolded rubber, .080 inch thick, and 4 inches high. Colors shall be selected by the Contracting Officer from the color samples provided by the Contractor. Preformed corners in matching size, profile, and color may be used for right-angle inside and outside corners.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install carpet and wallbase, as indicated on the plans and specified herein.

3.2 PREPARATION: Floors shall be clean and free of surface defects prior to installation of carpet.

3.3 INSTALLATION: Carpet and wallbase installation shall be accomplished in accordance with the manufacturer's written instructions. Installation shall include all carpet installation accessories necessary to make a complete installation.

3.4 CLEANING AND PROTECTION: Following installation, the entire surface of the carpet shall be vacuumed clean and protected from soiling. Any carpet soiled during or after installation, and prior to final acceptance, shall be thoroughly cleaned to the Contracting Officer's satisfaction using procedures and materials recommended by the carpet manufacturer.

3.5 REMNANTS: The Contractor shall bundle all sizable carpet remnants and turn them over to the building occupant. All carpet scraps too small to salvage as remnants shall be disposed of as specified.

DIVISION 9 - FINISHES

SECTION 09725

SEAMLESS QUARTZ FLOORING

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of seamless quartz flooring required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Assume publications shall to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

C579	Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings and Polymer Concretes.
D451	Standard Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products.
E84	Surface Burning Characteristics of Building Materials.

1.2.2 Military Specification (MS):

MIL-D-3134	Deck Covering Materials.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: Submit color and texture samples for selection of colors and textures.

1.3.3 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.4 Work Sample: Submit, at the Contracting Officer’s discretion, a 4 by 8 foot sample of the approved color and texture and when approved, this will serve as the standard for the entire project.

1.4 PRODUCT STORAGE AND ENVIRONMENTAL CONDITIONS: Material temperatures shall be a minimum of 55 degrees F. before use. Work on seamless flooring shall not commence until the building can be maintained at a minimum temperature of 55 degrees F. for 48 hours before, during and 48 hours after application. Areas should also be broom clean and reasonably dust free and shall have adequately controlled ventilation with bright, uniform lighting.

1.5 CONDITION OF SURFACES: Before commencing work, ensure environmental and site conditions are suitable for application and curing. Surfaces shall be acceptable in accordance with Flooring manufacturer's recommendations. Notify Contracting Officer and Contractor in writing of unsuitable surfaces and condi-

tions. Commencement of work shall imply acceptance of surfaces and working conditions.

1.6 PROTECTION: Protect adjacent surfaces from damage resulting from work of this trade. If necessary, mask and/or cover adjacent surfaces, fixtures, cabinet work, equipment, etc. by suitable means. Post "No Smoking" signs while work is in progress and curing.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 SEAMLESS QUARTZ FLOORING: Seamless floor covering shall be Desco Quartzite 6000 Series floor by Desco Coatings, Inc. 1-800-426-4164 or an approved equal.

2.2.1 Binder and all successive grout and top coats shall be 100 percent solids clear/epoxy resin. Ceramic coated quartz aggregates as supplied by Master Builders or approved or equal, are to be used to achieve all color. Quartz aggregate size to be Grade 11. (Grade 11 is defined by test method ASTM D451. 98 percent passing through as 10 mesh Tyler Screen. 98 percent retained on 20 mesh Tyler Screen.) No pigmented epoxy base or top coats allowed.

2.2.2 Minimum performance characteristics:

Property	**Characteristics**
Impact Resistance	Gardner Impact Test, 160 in/lb, no cracking, chipping or delamination
Indentation Resistance	MIL-D-3134, Section 4.74, withstands 2,000 lbs/sq in for 30 minutes without indentation
Tabor Abrasion Resistance	CS17 Wheels with 2,000 gm load for 10,000 cycles, 27.6 mg average loss per 1,000 cycles
Toxicity	U.S. Department of Agriculture Research Service Meat Inspection Division, Non-toxic
Flammability	ASTM E84 Tunnel Test, Flame Spread Classification (FSC) not to exceed 35.
Compressive Strength	ASTM C579, 10,088 psi
Chemical Resistance	Unaffected by 20% Hydrochloric Acid, 10% Lactic Acid, Urine, Tea, Coffee, Mustard, Ethyl Alcohol, Mercurochrome

PART 3 EXECUTION

3.1 GENERAL: Install seamless quartz flooring as indicated on the plans and specified herein.

3.2 INSTALLATION: Floors to be prepared as required by surfacing applicator. Acid etching, mechanical sanding or mechanical scarification will not be accepted. Install as detailed and required by latest printed instructions of manufacturer. Floor preparation as described above. Apply flooring in accordance with the manufacturer's latest printed instructions, employing technically-trained, approved mechanics using equipment specifically designed for this purpose. Flooring shall be tightly compacted and free from surface holes and depressions. On consecutive days, apply grout coat and two special high

abrasion resistant top coats. Finish work shall match approved samples; be uniform in thickness, sheen, color and texture; and be free from defects detrimental to appearance or performance. Approximate floor thickness shall be 1/8 inch.

3.3 CURING, CLEANING AND PROTECTION: Cure seamless flooring materials in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of curing process. Protect seamless flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and the method of their application. Remove temporary covering just prior to cleaning for final inspection. Clean seamless flooring just prior to final inspection. Use materials and procedures recommended by resinous flooring manufacturer.

DIVISION 9 - FINISHES

SECTION 09835

Special Coating Multi-Color Wall Finish

PART 1 - GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, material, and transportation necessary for the application of special coating multi-color wall finish required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

D1308	Effect of Household Chemicals on Clear and Pigmented Organic Finishes
D2486	Scrub Resistance of Wall Paints.
D3359	Measuring Adhesion by Tape Test
D-4060	Abrasion Resistance of Organic Coatings by the Taber Abraser
E84	Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: Submit color and texture samples for selection of colors and textures.

1.3.3 Application Instructions: Submit manufacturer's written application instructions.

1.3.3 Work Sample: Submit, at the Contracting Officer’s discretion, a 4 by 8 foot sample of the approved color and texture and when approved, this will serve as the standard for the entire project.

1.4 QUALITY ASSURANCE:

1.4.1 Applicator Qualifications: Engage an experienced applicator who has successfully completed coating system applications similar in material and extent to those indicated for this Project.

1.4.2 Single Source Responsibility: Provide primers and undercoat material produced by the same manufacturer as the finish coats. Use only thinners recommended by the manufacturer and only within recommended limits.

1.5 PRODUCT DELIVERY, STORAGE AND ENVIRONMENTAL CONDITIONS:

1.5.2 Environmental Conditions: Material temperatures shall be a minimum of 45 degrees F. before use. Work on wall coatings shall not commence until the building can be maintained at a minimum temperature of 45 degrees F. and a maximum temperature of 95 degrees F. for 48 hours before, during and 48 hours after application. Areas should also be reasonably dust free and shall have adequately controlled ventilation with bright, uniform lighting.

1.6 CONDITION OF SURFACES: Before commencing work, ensure environmental and site conditions are suitable for application. Surfaces shall be acceptable in accordance with wall finish manufacturer's recommendations. Notify Contracting Officer and Contractor in writing of unsuitable surfaces and conditions. Commencement of work shall imply acceptance of surfaces and working conditions.

1.7 PROTECTION: Protect adjacent surfaces from damage resulting from work of this trade. If necessary, mask and/or cover adjacent surfaces, fixtures, cabinet work, equipment, etc. by suitable means. Post "No Smoking" signs while work is in progress and curing.

PART 2 - PRODUCTS

2.1 MATERIALS: Materials furnished under this Section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current formula which conforms to the requirements specified.

2.2 SPECIAL COATING MULTI-COLOR WALL FINISH: Special coating system shall consist of a compatible prime coat and a polychromatic waterbased coating, consisting of a combination of separate pigmented resin particles suspended in a chemically treated aqueous solution.

2.2.1 Manufacturers offering products which are acceptable for this project include:

“Zolatone” by Surface Protection Industries International
“Polymyx” by Surface Protection Industries International
“Varitex” by MDC Wall Coverings

2.2.2 Minimum performance characteristics:

Property	Characteristics
Adhesion Test Over Primed Surfaces	ASTM D3359, Good.
Abrasion Resistance	ASTM D-4060-84, 168 mg loss/1000 Cycle, 1000 gms (weight).
Flammability	ASTM E84 Tunnel Test, Class “A” Fire Hazard Classification;
Stain Resistance	ASTM D-1308, Resistant to the Following: Mustard, Catsup, Butter, Orange Juice, Soda, Vegetable Oil, Acetic Acid, Gasoline, Motor Oil.
Scrubbability	ASTM D2486, 4150 Cycles (slight wear).
Resistance to Common Cleaners and Disinfectants	ASTM D1308, Film not affected.

PART 3 - EXECUTION

3.1 GENERAL: Apply special coating multi-color wall finish on walls as indicated on the plans and specified herein.

3.2 INSTALLATION: Apply coating in accordance with the manufacturer’s written application instructions, employing technically trained applicators, using equipment specifically designed for the purpose. Finished work shall match approved samples, be uniform in thickness, sheen, color and texture and be free from defects detrimental to appearance or performance.

DIVISION 9 - FINISHES

SECTION 09900

PAINTING, STAINING & VARNISHING

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the accomplishment of interior painting, staining, and varnishing required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 Federal Specifications (FS):

TT-P-19	Paint, Latex (Acrylic Emulsion, Exterior Wood and Masonry).
TT-P-29	Paints, Latex Base, Interior, Flat, White and Tints.
TT-P-102	Paint, Oil (Alkyd Modified, Exterior, White and Tints).
TT-V-109	Varnish, Interior, Alkyd-Resin.
TT-S-176	Sealer, Surface, Varnish Type, Floor, Wood or Cork.
TT-S-179	Sealer, Surface, Pigmented Oil, For Plaster or Wallboard.
TT-E-489	Enamel, Alkyd, Gloss, Low VOC Content.
TT-E-505	Enamel (Odorless, Alkyd, Interior, High Gloss).
TT-E-509	Enamel, Odorless, Alkyd, Interior, Semigloss, White and Tints.
TT-C-535	Coating, Epoxy, Two Component, For Interior Use on Metal, Wood, Wallboard, Painted Surfaces, Concrete, and Masonry.
TT-C-542	Coating, Polyurethane, Oil Free, Moisture Curing.
TT-E-545	Primer (Enamel-Undercoat, Alkyd, Odorless, Interior, Flat, Tints and White).
TT-P-641	Primer Coating, Zinc Dust-Zinc Oxide (For Galvanized Surfaces).
TT-P-645	Primer, Paint, Zinc-Molybdate, Alkyd Type.
TT-P-650	Primer Coating, Latex Base, Interior, White (For Gypsum Wallboard or Plaster).
TT-S-711	Stain; Oil Type, Wood Interior.
A-A-1500	Sealer, Surface (Latex Block Filler).

TT-P-1511	Paint, Latex (Gloss and Semigloss, Tints and White) (For Interior Use).

1.2.2 Federal Standard (FStd):

595	Colors.

1.2.3 Master Painters Institute (MPI):

MPI	(2001) Exterior Semi-Transparent Stain Solvent Based

1.2.4 Military Specifications (MS):

MIL-S-12935	Sealer, Surface, For Knots.

1.2.5 U.S. Army Technical Manual (TM):

5-618	Paints and Protective Coatings.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: Submit color samples for selection of colors.

1.3.3 Application Instructions: Submit manufacturer's written application instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items and the most current formula which conforms to the requirements specified.

2.2 FILLER: Masonry block filler shall conform to FS TT-P-19 or A-A-1500. Filler shall be white for ease of identification by the Contracting Officer.

2.3 PAINTS: Paints shall conform to FS TT-P-29, TT-P-37, TT-P-102, TT-E-489, TT-E-505, TT-E-509, TT-C-535, and TT-P-1511. Paints shall be the types indicated for the surfaces to be painted on the Painting Schedule. Colors and tints shall be selected by the Contracting Officer from samples provided by the Contractor. Colors and tints shall conform to FStd 595 or the manufacturer's color chart. Colors shall match existing colors when spot painting is specified.

2.4 POLYURETHANE: Polyurethane shall conform to FS TT-C-542. Polyurethane shall be the type indicated for the surface to be refinished on the Painting Schedule.

2.5 PRIMERS: Primers shall conform to FS TT-E-545, TT-P-641, TT-P-645, TT-P-650, and MS MIL-P-28582. Primers shall be the types indicated for the surfaces to be painted on the Painting Schedule. Unless otherwise specified, all primers shall be white for ease of identification by the Contracting Officer.

2.6 SEALERS: Sealers shall conform to FS TT-S-176, TT-S-179, and MS MIL-S-12935. Kilz Sealer, or an approved equal, shall be used for smoke damaged

wall and ceiling surfaces. Sealers shall be the types indicated for the surfaces to be painted on the Painting Schedule.

2.7 STAIN: Stain shall conform to FS TT-S-711. Stain shall be the type indicated for the surfaces to be stained on the Painting Schedule. Colors shall match the existing or be selected by the Contracting Officer from samples provided by the Contractor. Colors shall conform to the manufacturer's color chart.

2.8 VARNISH: Varnish shall conform to FS TT-V-109 and MPI 13. Varnish shall be the type indicated for the surfaces to be varnished on the Painting Schedule.

2.9 HAZARDOUS MATERIALS RESTRICTIONS: Filler, primer, paints or other finishes shall contain no lead or mercurial fungicides.

PART 3 EXECUTION

3.1 GENERAL: Perform surface preparation, seal, prime, and paint interior building surfaces as specified herein. All surfaces indicated on the Painting Schedule shall be repaired and receive the surface preparation specified, seal coat, prime coat, and finish coats in the number necessary to achieve complete hiding.

3.2 PREPARATION FOR PAINTING: Builder's hardware; cabinets, countertops; carpets and rugs; electrical, fire protection, heating and air conditioning devices and components; furnishings; naturally finished wood; plumbing fixtures; room numbers; and similar items in contact with surfaces to be painted, stained, and varnished shall be removed, if easily removable, masked or otherwise protected prior to surface preparation, painting, staining, and varnishing operations. Doors shall operate freely upon completion of painting operations. Following the completion of painting, staining, and varnishing of each space, items removed shall be reinstalled. Removal and reinstallation of such items shall be accomplished by workmen qualified to perform such work. Damage caused by surface preparation, painting, staining, and varnishing operations shall be repaired, or damaged items replaced with items of equal design and quality, approved by the Contracting Officer at no cost to the Government.

3.3 SURFACE PREPARATION: Preparation for painting, staining, and varnishing all surfaces shall be accomplished in accordance with the finish manufacturer's written instructions, TM 5-618, and the requirements herein. All surfaces to be painted, stained, and varnished shall be clean, have holes and cracks patched, and be free from surface defects and deterioration prior to application of filler, sealer, primer, paint, or other finishes. Cleaning and sanding shall be so programmed that dust and other contaminants from the cleaning and sanding processes will not fall on wet, newly painted, stained, and varnished surfaces.

3.4 APPLICATION: The application of filler, sealer, primer, paint, or other finishes shall be accomplished in accordance with the finish manufacturer's written instructions and TM 5-618. Manufacturer's written instructions take precedence over other instructions or practices.

3.4.1 Filling: New and bare repaired concrete and masonry surfaces shall be coated with masonry block filler.

3.4.2 Staining: All bare wood to receive a natural wood finish shall be stained with a stain which matches the existing stain color and shade, or the color of stain selected by the Contracting Officer.

3.4.3 Sealing: All newly stained surfaces shall receive one coat of sealer and be lightly sanded prior to application of prime and finish coats. All new and bare repaired gypsum wallboard and plaster surfaces shall receive one coat of sealer prior to application of prime and finish coats. Knots in wood surfaces shall be coated with knot sealer.

3.4.4 Priming: Unless otherwise specified, all surfaces shall receive one coat of primer prior to application of the finish coat. Exposed ferrous metal shall be rust free and primed with zinc-molybdate primer. Exposed galvanized metal shall be scale free and primed with zinc dust-zinc oxide primer.

3.4.5 Finish Coats: Unless otherwise specified or required by the paint manufacturer, all surfaces shall receive one finish coat of paint or other finish as specified. Additional finish coats shall be applied as necessary to achieve complete hiding at no additional cost to the Government.

3.4.6 Spray Painting: Spray painting is not permitted.

3.5 SPECIAL INSTRUCTIONS: The special instructions listed below apply to painting, staining, and varnishing requirements indicated on the Painting Schedule:

3.5.1 Surfaces to be Painted: Surfaces to be painted on the Painting Schedule refers to all interior building surfaces including, but not limited to, pilasters, soffits, fasciae, moulding and millwork, doors, windows, beams, roof trusses, arms vault and supply caging, pipes, pipe hangers, pipe coverings, ducts, grilles, registers, louvers, radiators, finned tube radiation covers, conduits, and tubing.

3.5.2 Factory-Prefinished Components: Factory-prefinished components shall not be painted.

3.5.3 Open Stairways: Painting of open stairways includes walls, ceilings, stair stringers, risers, moulding, handrails, spindles, balusters, and complete balustrades from floor to floor. Stair treads are not included.

3.6 CLEANUP: All rags and drop cloths which constitute a fire hazard shall be placed in closed metal containers or disposed of at the end of each day. Upon completion of the work, all painting equipment, and paint and waste containers shall be removed from the site and disposed of as specified. Paint drips, splatters, or stray brush marks upon adjacent surfaces such as cabinets, countertops, naturally finished wood, plumbing fixtures, HVAC components, electrical devices, and lighting fixtures shall be removed, and the entire work area left clean and free of equipment and waste. Remove paint and wash door and window glass both inside and outside upon completion of painting operations.

3.7 PAINTING SCHEDULE:

Exterior Surfaces:

Surfaces To Be Painted	**Seal Coat When Specified**	**Prime Coat When Specified**	**Finish Coat And Additional Finish Coats As Required To Achieve Complete Hiding**
Concrete and Masonry Surfaces	TT-P-19 or TT-P-620 or A-A-1500	TT-P-19 (Latex)	TT-P-19 (Satin, Latex)
Metal Trim, Handrails, Railings, Doors, Door Frames	n/a	TT-P-641 or TT-P-645 (Alkyd)	TT-P-102 or TT-E-489 (Satin, or Semigloss, Alkyd-Oil)
Exterior Wood Door, Natural Wood Finish	n/a	MPI 13 (Satin or Semi-gloss)	MPI 13 (Satin or Semi-gloss)
Exterior Wood Surfaces Not Otherwise Specified	MIL-S-12935	Prime New and Bare Repaired Surfaces w/ MIL-P-28582 (Alkyd) Otherwise Prime w/ TT-P-1984 (Latex)	TT-P-102 (Satin or Semigloss, Alkyd-Oil) or TT-P-1510 (Satin or Semigloss, Latex)
Exterior Metal Surfaces Not Otherwise Specified	n/a	TT-P-641 or TT-P-645 (Alkyd)	TT-P-102 or TT-E-489 (Satin or Semigloss, Alkyd-Oil)
Interior Surfaces:			
Concrete, Masonry, Plaster or Gypsum Wallboard in Food Preparation Areas, & Latrines	TT-P-19 or A-A-1500 Concrete or Masonry TT-S-179 Plaster or Gypsum Wallboard	TT-C-535 (Epoxy)	TT-C-535 (Epoxy)
Concrete, Masonry, Plaster or Gypsum Wallboard in Corridors, Entryways, Mechanical Rooms, Stairways, & Storage Rooms	TT-P-19 or A-A-1500 Concrete or Masonry TT-S-179 Plaster or Gypsum Wallboard	TT-P-29 TT-P-650 (Latex)	TT-P-1511 (Semigloss, Latex)
Concrete, Masonry, Plaster, or Gypsum Wallboard in all except Kitchens, Dining, & Bathrooms	TT-P-19 or A-A-1500 Concrete or Masonry TT-S-179 Plaster or Gypsum Wallboard	TT-P-29 TT-P-650 (Latex)	TT-P-1511 (Flat or Satin, Latex)
Concrete, Masonry. Plaster, or Gypsum	TT-P-19 or A-A-1500	TT-P-29 TT-P-650	TT-P-1511 (Satin or Semigloss,

Wallboard in Offices & Other Rooms not Specified	Concrete or Masonry TT-S-179 Plaster or Gypsum Wallboard	(Latex)	Latex)
Interior Metal Doors & Frames w/ Painted Finish	n/a	TT-E-545 (Alkyd)	TT-E-509 (Satin, Alkyd-Enamel)
Exterior Metal Doors, Door Frames w/ Painted Finish	n/a	TT-P-645 (Alkyd)	TT-P-102 or TT-P-489 (Satin or Semigloss, Alkyd-Oil)
Wood Moulding & Millwork w/ Painted Finish	MIL-S-12935	TT-E-545 (Alkyd)	TT-E-509 (Satin or Semigloss, Alkyd-Enamel)
Wood Shelving in all Locations	MIL-S-12935	TT-E-545 (Alkyd)	TT-E-509 (Semigloss, Alkyd-Enamel)
Doors & Other Wood Surfaces w/New Natural Wood Finish	Stain w/ TT-S-711 & Seal w/ TT-S-176	TT-V-109 or TT-C-542 (Satin or Semigloss)	TT-V-109 or TT-C-542 (Satin or Semigloss)
Interior Wood Surfaces Not Otherwise Specified	MIL-S-12935	Prime New & Bare Repaired Surfaces w/ TT-E-545 (Alkyd) Otherwise Prime w/ TT-P-29 (Latex)	TT-E-509 (Satin or Semigloss, Alkyd-Enamel) or TT-P-1511 (Satin or Semigloss, Latex)
Interior Metal Surfaces Not Otherwise Specified	n/a	TT-E-545 or TT-P-641 or TT-P-645 (Alkyd)	TT-E-509 (Semigloss, Alkyd-Enamel)

DIVISION 10 – SPECIALTIES

10160	Toilet Partitions
10260	Wall and Corner Guards
10440	Interior Signage
10505	Metal Lockers
10520	Fire Extinguisher Cabinets
10650	Operable Partitions
10800	Toilet Accessories

DIVISION 10 - SPECIALTIES

SECTION 10160

TOILET PARTITIONS

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of toilet partitions required in this project.

1.2 APPLICABLE PUBLICATIONS: The Federal Specification (FS) listed below forms a part of this section to the extent referenced. The publication is referred to by basic designation only. The publication shall be assumed to be the most current edition in effect at the time a contract is awarded.

RR-P-1352 Partitions, Toilet, Complete.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: The Contractor shall submit color samples for selection of colors.

1.3.3 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products or manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 TOILET COMPARTMENTS: Toilet compartments shall conform to FS RR-P-1352, Type I, Style C - overhead braced, and Finish indicated below. Doors and stiles shall have a 3/4-inch finished thickness. Panels shall have a 1/2-inch finished thickness. Each toilet compartment shall have a door-mounted clothes hook, door stop, door latch, and stainless steel double roll toilet tissue holder. Toilet compartments shall be the size and configuration indicated on the plans.

2.3 URINAL SCREENS: Urinal screens shall conform to FS RR-P-1352, Type III, Style A - floor supported, and Finish indicated below. Stiles shall have a 3/4-inch finished thickness. Panels shall have a 1/2-inch finished thickness. Urinal screens shall be the size and configuration indicated on the plans.

2.4 HARDWARE: The Contractor shall provide all parts, hardware, fasteners, and anchors necessary for complete installation of toilet partitions. All hardware and fasteners shall be stainless steel with a type 304 satin finish. Fasteners shall be tamper-proof, but removable for replacement.

2.5 COLOR AND FINISH: Color of toilet partitions shall be selected by the Contracting Officer from the manufacturer’s full range of color and pattern samples provided by the Contractor. Finish shall be Finish 5 - solid plastic.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install the toilet partitions indicated on the plans and specified herein.

3.2 INSTALLATION: Installation of toilet partitions shall be in accordance with the manufacturer's written installation instructions.

DIVISION 10 - SPECIALTIES

SECTION 10260

WALL AND CORNER GUARDS

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of wall and corner guards required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

D256	Impact Resistance of Plastics and Electrical Insulating Materials.
D635	Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
E84	Surface Burning Characteristics of Building Materials.

1.2.2 Society of American Automotive Engineers (SAE) Publication:

J1545	Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Color Trim.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials and systems proposed for use in work under this section.

1.3.2 Samples: Submit a sample of each sign type showing typical quality and workmanship. Submit color samples for selection of colors.

1.3.3 Installation Instructions: Submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERILAS: Materials furnished under this section shall be standard products of a single manufacturer regularly engaged in the production of the signage, and the most current design which conforms to the requirements specified.

2.2 WALL AND CORNER GUARDS: Wall and corner guards shall consist of extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic and shall conform to the following:

2.2.1 Minimum Impact Resistance: Minimum impact resistance shall be 960.8 N.m/m (18 ft.lbf/in) (18 ft.lbs) when tested in accordance with ASTM D256, (Izod impact, foot-pounds/inch notch).

2.2.2 Fire Rating: Fire rating shall be Class 1 when tested in accordance with ASTM E84, 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 D635.

2.2.3 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.

2.3 FASTENERS AND ANCHORS: Fasteners and anchors shall be provided for each specific installation.

PART 3 EXECUTION

3.1 GENERAL: Install wall and corner guards as indicated on the plans and specified herein.

3.2 INSTALLATION: Install wall and corner guards in accordance with the manufacturer's written installation instructions.

DIVISION 10 - SPECIALTIES

SECTION 10440

INTERIOR SIGNAGE

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of interior signage required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standard:

A117.1	Providing Accessibility to and Usability by Physically Handicapped People.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

D4802	Poly(Methyl Methacrylate) Acrylic Plastic Sheets.
D5436	Poly(Methyl Methacrylate) Plastic Rods, Tubes and Shapes.

1.2.3 Federal Specification (FS):

L-P-387	Plastic Sheet, Laminated, Thermosetting (For Designation Plates).

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials and systems proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.3 Samples: Submit a sample of each sign type showing typical quality and workmanship. Submit color samples for selection of colors.

1.3.4 Shop Drawings: Submit shop drawings including elevations of each type of sign; show 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.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of a single manufacturer regularly engaged in the production of the signage, and the most current design which conforms to the requirements specified.

2.2 ACRYLIC PLASTIC: Poly(Methyl Methacrylate) plastic sheet shall conform to ASTM D4802, Category B-1, Finish 1. Plastic rods, tubes, and shapes, if

used, shall conform to ASTM D5436. Laminated plastic sheet shall conform to FS L-P-387.

2.3 ANCHORS AND FASTENERS: Exposed anchor and fastener materials shall be compatible with metal to which applied and shall have matching color and finish.

2.4 INTERIOR SIGNS:

2.4.1 MINIMUM SIGN REQUIREMENTS:

2.4.1.1 General: Signs shall be the size, type, style, and contain the messages indicated. Options shall be selected by the Contracting Officer from samples furnished by the Contractor.

2.4.1.2 Americans with Disabilities Act: All signs shall conform to the requirements of ANSI A117.1. These requirements include types of signs, tactile and Braille characters, typestyles, character height, pictograms (symbols), finish and contrast, and mounting location and height.

2.4.1.3 Workmanship: Holes for fasteners 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.

2.4.1.4 Dissimilar Materials: Where dissimilar metals are in contact, surfaces shall be protected to prevent galvanic or corrosive action.

2.4.1.5 Mounting: Mount surface mounted signs with 1/16 inch thick vinyl double-face tape or countersunk mounting holes in plaque base and mounting screws. Mount building directories to the wall with mechanical fasteners through horizontal aluminum cleats.

2.4.1.5.1 Provide matte finish acrylic back plate to conceal mounting or sign on opposite side of glass mounted installations.

2.4.6 Tactile Plaque Signs: Tactile plaque signs shall consist of matte finish acrylic outer surface with tactile characters, Braille and pictogram, acrylic graphics layer, and acrylic base surface.

2.5 DIMENSIONAL CHARACTERS:

2.5.1 CAST CHARACTERS: Form individual letters by casting. Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Cast characters shall be aluminum, 3 inches high, Times New Roman style and manufactured by ASI Sign Systems Inc., Metal Arts; Div. of L&H Mfg., Mohawk Sign Systems, or an approved equal.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install the sizes and types of signs at the designated locations as indicated on the plans and specified herein. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation.

3.2 INSTALLATION: Signs shall be installed in accordance with the manufacturer's written installation instructions and the details indicated. Signs shall be installed plumb and true at mounting heights indicated, and by method

shown or specified. 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. Signs on doors or other surfaces shall not be installed until finishes on such surfaces have been repaired.

3.3 PROTECTION AND CLEANING: The work shall be protected against damage during and following installation. Cleaning shall be in accordance with the manufacturer’s written instructions.

DIVISION 10 - SPECIALTIES

SECTION 10505

METAL LOCKERS

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of metal lockers required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

A505	Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, General Requirements.
A506	Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, Regular Quality and Structural Quality.

1.2.2 Federal Specification (FS):

AA-L-486	Lockers, Clothing, Steel.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: The Contractor shall submit color samples for selection of colors.

1.3.3 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements herein.

2.2 METAL LOCKERS: Metal lockers shall conform to the applicable portions of FS AA-L-486. Metal lockers shall be fabricated from steel sheet conforming to ASTM A505 and A506. Sides and backs shall be a minimum of 26-gauge steel. Framework and doors shall be a minimum of 16-gauge steel. Metal lockers shall be size and configuration shown on the plans. Locker shall have louvered doors. Lockers and accessories shall have a factory applied baked enamel finish. Color of lockers shall be selected by the Contracting Officer from samples provided by the Contractor.

2.3 HARDWARE: Metal lockers shall be furnished with all hardware to make complete installations including 2 hinges, padlocking handle, 1 double prong and 3 single prong clothes hooks, and 1 number plate per opening.

2.4 ACCESSORIES: Metal locker installation shall include 4-inch high metal locker base and sloping hoods. Color of accessories shall match lockers.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install metal lockers, hardware and accessories as indicated on the plans and specified herein.

3.2 INSTALLATION: The installation of metal lockers, hardware, and accessories shall be accomplished in accordance with the applicable portions of FS AA-L-486 and the manufacturer's written installation instructions.

DIVISION 10 - SPECIALTIES

SECTION 10520

FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of fire extinguishers, cabinets and accessories required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 National Fire Protection Association (NFPA) Publication:

10 Portable Fire Extinguishers.

1.2.2 Underwriters Laboratories (UL) Publication:

299 Dry Chemical Fire Extinguishers.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

1.3.3 Samples: The Contractor shall submit fire extinguisher cabinet finish samples and door designs for selection of finishes and designs.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 FIRE EXTINGUISHERS: Fire extinguishers shall be multi-purpose dry chemical for class A:B:C fires, 10 pound, (class 2-A:40-B:C per UL 299), and conform to NFPA 10.

2.3 FIRE EXTINGUISHER CABINETS:

2.3.1 Fire Extinguisher Cabinets: Fire extinguisher cabinets shall be fully recessed. Cabinet boxes shall be fabricated from 18 gauge steel and have a white baked enamel finish inside and outside. Cabinet trim and door frames shall be fabricated from 304 stainless steel with a No. 4 brushed finish. Doors shall be 1/2 inch thick and have continuous piano hinge, satin finish pull, self-adjusting roller catch, and black die cut lettering with the words “FIRE EXTINGUISHER” placed vertically, reading bottom to top. Cabinets shall be equipped with the fire extinguisher specified above.

2.3.2 Provide manufacturer’s standard mounting bracket at locations where a cabinet is not indicated.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install fire extinguishers, cabinets and accessories as indicated on the plans and specified herein.

3.2 INSTALLATION: Installation of the fire extinguishers, cabinets and accessories shall be in accordance with the manufacturer's written installation instructions.

DIVISION 10 - SPECIALTIES

SECTION 10650

OPERABLE PARTITIONS

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of operable partitions required in this project.

1.2 APPLICABLE PUBLICATIONS: The American Society for Testing and Materials (ASTM) publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

C423	Sound Absorption and Sound Absorption Co-Efficients by the Reverberation Room Method.
E84	Surface Burning Characteristics of Building Materials.
E90	Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
E413	Classification for Rating Sound Insulation.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

1.3.3 Samples: The Contractor shall submit color, texture and pattern samples for selection of partition finishes.

1.3.4 Shop Drawings: The Contractor shall submit shop drawings of the proposed fabrication and installation of operable partitions. Shop drawings shall show dimensions, construction, head and jamb conditions and stacking space.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 OPERABLE PARTITIONS: Operable partitions shall be suspended manually operated individual panels, and the size indicated on the plans. Partitions shall have a minimum Sound Transmission Class (STC) of 52 when tested in accordance with ASTM E90 and E413, and a Class A flame spread and smoke developed classification when tested in accordance with ASTM E84.

2.2.1 Construction: Panels shall be all steel construction nominally 4″ thick in manufacturer’s standard widths. All framing elements shall be 14 ga. steel. Panel skin shall be minimum 21 gauge steel, invisibly welded to

frames. Panel cores shall be insulated as required to meet acoustical performance and provide rigid backing for skin. Maximum hanging weight shall be 12 pounds per square foot.

2.2.2 Hardware: Hardware shall include manufacturer's standard hinges, anchor plates, hangers, trolleys, and carriers.

2.2.3 Panel Surfaces: Outer covering shall be 100% polyolefin woven fabric equal to Panelfold, Tek-Wall 1000, 165 “Spray Mist”.

2.2.3.1 Outer covering at Concourse 103 side of operable partitions shall be Formica 1150-43, “Vosges Pear”, matte finish. Meeting room side covering shall be as specified above.

2.2.5 Tracks and Hangers: Suspension system shall be by means of continuous heavy duty aluminum track fastened to structure above with adjustable steel hangar rods. The partition shall be supported by four-wheel ball bearing trolley assemblies at each volute running in the track.

2.2.6 Sound Seals: Vertical sound seals shall be provided between each panel. Horizontal top seals shall be continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers. Floor seal shall be operable with sufficient downward pressure to assure an acoustic seal and resist panel movement.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install operable partitions as indicated on the plans and specified herein.

3.2 INSTALLATION:

3.2.1 Partitions shall be installed in prepared openings in accordance with the manufacturer's written installation instructions and the Contractor's approved shop drawings.

3.2.2 Partitions shall be adjusted for smooth, quiet, trouble-free operation prior to final acceptance.

DIVISION 10 - SPECIALTIES

SECTION 10800

TOILET ACCESSORIES

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation and replacement of toilet and bath accessories required in this project.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 Federal Specifications (FS):

FF-D-396	Dispensers, Soap.
DD-M-411	Mirrors, Glass.
WW-P-541	Plumbing Fixtures (General Specification).
WW-P-541/8	Plumbing Fixtures (Accessories), (Detail Specification).
WW-D-1908	Dispenser, Toilet Paper, Cabinet.
WW-H-1911	Holder, Toilet Paper (Single Roll).
A-A-2380	Dispenser, Paper Towel.

1.2.2 National Fire Protection Association (NFPA) Standard:

70	National Electrical Code (NEC).

1.2.3 Underwriters Laboratories (UL) Publication:

1571	Incandescent Lighting Fixtures.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 BARS (GB): Surface-mounted bars shall conform to FS WW-P-541 and WW-P-541/8, Type IV, Class 2 - grab. Bars shall be stainless steel.

2.3 MIRRORS (MR): Mirrors shall conform to FS DD-M-411, Class 2 - surface mounted, Style E - metal frame, and Grade 2 - Type 430 stainless steel. Mirrors shall have No. 1 quality, 1/4-inch float/plate glass mirror, and have a stainless steel frame.

2.4 PAPER TOWEL DISPENSERS (PTD): Paper towel dispensers shall conform to FS A-A-2380, and be Type 1 - single fold towel, surface mounted. Dispensers shall be stainless steel, bright chrome or brass plated steel, or baked enamel coated steel.

2.5 UTILITY SHELF WITH MOP AND BROOM HOLDER AND RAG HOOKS: Single surface-mounted shelves shall conform to FS WW-P-541 and WW-P-541/8, Type V, Class 2 - metal. Shelves shall be stainless steel.

2.6 SOAP DISPENSERS (SD): Soap dispensers shall conform to FS FF-D-396, Type VII - lather, and be surface mounted. Soap dispensers shall be stainless steel.

2.7 TOILET TISSUE DISPENSER (TTP): Toilet tissue dispensers shall conform to FS WW-H-1911, Type I - roller mounted on two surface-mounted support brackets. Multi-roll toilet paper dispensers shall conform to FS WW-D-1908, Type II - 2 roll. Toilet tissue dispensers shall be stainless steel.

2.8 SANITARY NAPKIN DISPENSER (SND): Sanitary napkin dispenser shall conform to FS WW-P-541 and WW-P-541/8, Type I, Class 5, sanitary napkin and tampon, surface mounted. Dispensers shall be stainless steel.

2.9 SANITARY NAPKIN RECEPTACLE (SNR): Sanitary napkin receptacle shall be constructed of Type 304 stainless steel with removable leak-proof disposable liners. Fifty disposable liners of the type standard with the manufacturer shall be provided. Liners shall be retained in cabinet by tumbler lock. Receptacle shall be provided with a door for inserting disposed napkins, and shall be partition mounted.

2.10 HARDWARE: The Contractor shall provide all parts, hardware and fasteners necessary for the installation of toilet and bath accessories. All hardware and fasteners shall be stainless steel. Fasteners shall be tamper-proof, but removable for replacement.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install and replace toilet and bath accessories as indicated on the plans and specified herein.

3.2 INSTALLATION: Installation of toilet and bath accessories shall be accomplished in accordance with the manufacturer's written installation instructions.

DIVISION 11 – EQUIPMENT

11132	Projection Screen
11160	Loading Dock Equipment
11400	Food Service Equipment

DIVISION 11 - EQUIPMENT

SECTION 11132

PROJECTION SCREENS

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of projection screens required in this project.

1.2 APPLICABLE PUBLICATIONS: The Federal Specification (FS) listed below forms a part of this section to the extent referenced. The publication is referred to by basic designation only. The publication shall be assumed to be the most current edition in effect at the time a contract is awarded.

GG-S-00172 Screen, Projective.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 PROJECTION SCREENS: Provide manufacturer's standard fully recessed UL-listed and marked units consisting of case, screen, motor, controls, mounting accessories and other components as required for a complete installation and complying with requirements indicated for screen surface, controls and for case, motor and screen under description of operation and type.

2.2.1 Viewing Surface of Screen: Viewing surface of screen shall be matte white viewing surface with minimum gain characteristics complying with FS GG-S-00172D Class A or glass beaded viewing surface with minimum gain characteristics complying with FS GG-S-00172D Class C. Edge treatment shall be black masking borders. Screen shall be mildew- and flame-resistant vinyl-coated glass fiber or polyvinyl fabric with viewing surface complying with requirements indicated, with top edge mounted on, and securely anchored to, 3-inch diameter rigid metal roller supported by vibration- and noise-absorbing supports and bottom edge formed into a pocket holding a 3/8-inch diameter metal rod, with end of rod protected by plastic caps. Provide size of screen indicated.

2.2.2 Screen Controls: Remotely control operation of each screen with three-position, UL-listed control switch for each screen with metal device box and cover plate for flush wall mounting and for connection to 120 Volts AC electric power supply.

2.2.3 Screen Case: Fabricated in one piece from 22-gauge steel with flat back design, vinyl-covered or baked-enamel finish, and mounting brackets for a fully recessed installation in drywall or suspended acoustical ceilings.

2.2.4 Motor: Instant reversing motor of size and capacity recommended by screen manufacturer, with permanently lubricated ball bearings, automatic thermal overload protection, preset limit switches to automatically stop screen in "up" and "down" position, and positive stop action to prevent coasting; mounted inside roller with vibration insulators to reduce noise transmission and remotely controlled as indicated.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install projection screens as indicated on the plans and specified herein.

3.2 INSTALLATION: Installation of the projection screen shall be in accordance with the manufacturer's written installation instructions.

DIVISION 11 - EQUIPMENT

SECTION 11160

LOADING DOCK EQUIPMENT

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of loading dock equipment required in this project.

1.2 APPLICABLE PUBLICATIONS: None.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

1.3.3 Shop Drawings: The Contractor shall submit shop drawings of the proposed installation of dock bumpers and dock seals.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items and most current design which conforms with the requirements specified.

2.2 DOCK BUMPERS: Dock bumpers shall be laminated rubber 12 inches high, 96 inches wide, and 4-1/2 inches thick, and shall be provided with all accessories, hardware and fasteners necessary for complete installation. Dock bumpers shall be Dura-Dock, Model B412-X101-AD1, or an approved equal.

2.3 DOCK LIFT: Dock lift shall consist of a 6 ft. by 8 ft. steel safety tread platform with throw over bridge and ramp on scissors lift frames operated by two heavy duty piston type cylinders and powered by a 230 volt, 3ph electric hydraulic power unit with 24 volt electric controls. Dock lift shall be surface mounted. Handrails shall be provided on two sides with a safety chain across both ends per OSHA requirements. Dock lift shall have a lifting capacity of 5000 lbs. with a raised height of 60 inches. The lift shall conform to U.S. Commercial Standard CS 202-56, OSHA, BOCA and the National Electric Code and be provided with a removable safety maintenance leg. Lift shall be provided with a 5 year structural warranty and have a baked on enamel finish.

2.3.1 Dock lift shall be Advance model number 6100 or approved equal.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install loading dock equipment as indicated on the plans and specified herein.

3.2 INSTALLATION: The installation of loading dock equipment shall be accomplished in accordance with the equipment manufacturer's written installation instructions and the Contractor's approved drawings.

DIVISION 11 - EQUIPMENT

SECTION 11400

FOOD SERVICE EQUIPMENT

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of food service equipment required in this project.

1.1.1 General: Equipment shall be delivered into the building, uncrated, assembled, hung, set-in-place, leveled and completely installed exclusive of the rough-in and all electrical, ventilation and plumbing connections. This work shall be performed in such a manner as to complete the installation of each individual piece of equipment to perform the function for which it is designed. The project includes equipment provided / relocated in the following manners (as designated on drawings);

1.1.1.1 Contractor provided and installed.

1.1.1.2 Owner supplied, contractor installed.

1.1.1.3 Contractor modified / relocated.

1.1.1.4 Vendor relocated equipment.

1.1.1.5 Vendor provided equipment.

1.1.1.6 Owner provided and installed.

1.1.1.7 Owner scraped existing equipment (as specified, not shown)

1.1.1.8 Owner and vendor supplied or provided equipment, which varies from that which is specified and shown, is the responsibility of the owner to coordinate with the contractor.

1.1.1.9 Contractor shall walk through current kitchen with owner and designate items to be relocated / reused. Remainder of equipment to be removed and scraped by the owner.

1.1.1.10 All equipment must be removed from the building during initial construction activities. Contractor is responsible for moving equipment, designated for reuse / relocation / modification, to and from an owner designated storage facility on Fort Riley.

1.1.1.11 Contractor will be required to provide the owner a hand receipt for equipment which is removed, temporarily, from Fort Riley, for modification.

1.1.1.12 Contractor will move owner supplied and provided equipment from a storage facility on Fort Riley to the new kitchen.

1.1.2 Mechanical Connections: For required drain traps, steam traps, atmospheric vents, valves, pipes and pipe fittings, duct work, and other materials necessary to complete mechanical hookup of food service equipment refer to the specifications governing other trades. Rough-in and connections are included under other contractor's work.

1.1.3 Electrical Connections: For wiring, disconnects, and other materials necessary to complete electrical hookup of food service equipment refer to the specifications governing other trades. Rough-in and connections are included under other contractor's work.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Gas Association (AGA) Publication:

Certified Appliances and Accessories Directory.

1.2.2 American National Standards Institute (ANSI) Standards:

B16.18	Cast Copper Alloy Solder Joint Pressure Fittings.
B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes.
Z21.15	Manually Operated Gas Valves.
Z21.41	Quick-Disconnect Devices for Use With Gas Fuel.
Z21.45	Flexible Connectors of Other Than All-Metal Construction for Gas Appliances.

1.2.3 American Society for Testing and Materials (ASTM) Publications:

A36/A36M	Structural Steel.
A167	Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet and Strip.
A240	Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip For Pressure Vessels.
B75	Seamless Copper Tube.
B88	Seamless Copper Water Tube.

1.2.4 Federal Specifications (FS):

OO-M-38	Mixing Machines, Food, Electric (Vertical Commercial Type, Bakery and Kitchen).
OO-V-185	Vegetable Peeling Machine, Electric.
AA-R-200	Refrigerator, Mechanical, Commercial; Self-Contained, Reach-In and Pass-Through.
OO-M-280	Meat Slicer, Hand-Operated, and Meat-Slicing Machines, Electric.
WW-P-351	Pipe; Red Brass (Copper Alloy No. 230), Seam-Seamless Standard Pipe Size, Regular and Extra Strong.

OO-D-431	Dishwashing Machines, Commercial (Rack, Stationary).
WW-P-460	Pipe Fittings; Brass or Bronze (Threaded) 125 and 250 Pound.
W-C-500	Coffee Maker, Electric, Automatic.
WW-P-541	Plumbing Fixtures (General Specification).
QQ-B-654	Brazing Alloy, Silver.
S-F-695	Fryers, Deep Fat (Electric).
A-A-50042	Ovens, Baking and Roasting, Forced Convection.
A-A-50064	Ranges, Gas, Commercial.
A-A-50126	Racks, Food Service Trays.
A-A-50138	Freezer, Mechanical, Food.

1.2.5 International Association of Plumbing and Mechanical Officials (IAPMO) Publication:

Uniform Plumbing Code (UPC).

1.2.6 Military Specifications (MS):

MIL-T-2256	Tables, Food Preparation, and Racks, Table, Kitchen Utensils.
MIL-G-2338	Griddles, Self-Heating, Electric; and Stands, Griddle.
MIL-R-11295	Ranges, Electric, Commercial (With or Without Broiler).
MIl-I-11867	Ice Making Machine, Cube.
MIL-G-15840	Garbage Disposal Machines, Commercial and Household.
MIL-C-23880	Cabinets, Food Warming, Electric, Pass-Through and Reach-In.
MIL-S-40144	Shelving, Storage, Stationary and Mobile, Food Service.
MIL-0-40155	Openers, Can, Electric, Heavy Duty.
MIL-D-40631	Dispensers, Tableware, Self-Leveling.
MIL-U-43263	Urn, Coffee, Twin and Single, Automatic (Electric, Steam, and Gas).
MIL-D-43845	Dispenser, Iced Tea.
MIL-H-43895	Heaters, Hot Water Booster, Electric; Sink Sanitizing.

1.2.7 Military Standard (MStd):

130G	Identification Marking of U.S. Military Property.

1.2.8 National Association of Plumbing-Heating-Cooling Contractors (NAPHCC) Publication:

01 National Standard Plumbing Code (NSPC).

1.2.9 National Electrical Manufacturers Association (NEMA) Publications:

ICS 1 General Standards for Industrial Controls and Systems.

ICS 6 Enclosures for Industrial Controls and Systems.

WD 1 Wiring Devices.

1.2.10 National Fire Protection Association (NFPA) Standards:

54 National Fuel Gas Code (NFGC).

70 National Electric Code (NEC).

96 Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.

1.2.11 Underwriters Laboratories (UL) Publications:

197 Commercial Electric Cooking Appliances.

710 Grease Extractors for Exhaust Ducts.

Electrical Appliance and Utilization Equipment Directory.

1.2.12 U.S. Department of Health, Education and Welfare Publication:

Food and Drug Administration Food Service Sanitation Regulations.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: The Contractor shall submit color samples for selection of colors.

1.3.3 Installation, Operation, and Maintenance Instructions: The Contractor shall submit three bound sets of manufacturer's written installation, operation, and maintenance instructions for each item of food service equipment. This submittal shall include product data sheets, wiring diagrams, parts list and service agency.

1.3.4 Utility Requirement Drawings: Submit one (1) set of legible reproducible ozalid (sepia) prints and one (1) set of blueline prints of the 1/4 inch scale dimensioned utility rough-in plans. These shall be "rough-in" plans, not "point-of-connection" plans and shall show plumbing, electrical and mechanical requirements. Include in these plans all utilities for any re-used existing equipment called for in these specifications. Utility drawings shall reflect requirements of ALL equipment shown (contractor, owner & vender supplied / provided) as specified, bid and accepted. Owner is responsible for providing information concerning any deviations in utility requirements

required by their acceptance of equipment varying from that which is specified and shown. Drawings shall be submitted rolled within a mailing tube fully protected for shipment. After approval this contractor shall print the number of prints as required for distribution. Drawings shall include the following:

1.3.4.1 Lateral, longitudinal and height dimensions, locating rough-in points for utility connections from fixed points (i.e. wall, columns, etc.). Where walls are directly adjacent to equipment, all Mechanical and Electrical rough-ins shall occur within those walls to minimize floor obstructions. Floor penetrating rough-in locations at island equipment locations (ie: tables, sinks, etc.) shall be directly adjacent to table legs or under equipment adequately so it?s not exposed readily to abuse or presents a hazard to the equipment user.

1.3.4.2 Connecting sizes, loads, electrical characteristics, etc., for equipment at its rough-in points.

1.3.4.3 Utility sizing and locations shall be in accordance with exact equipment to be furnished and its installation.

1.3.4.4 Diagrams showing proper assemblage, installation, and inter-connection/connection of parts furnished by the food service equipment provider, and installed by other trades.

1.3.4.5 Wall, roof, floor and ceiling openings required for complete installation of equipment.

1.3.4.6 Notes explaining special or unusual conditions which affect work of other trades.

1.3.4.7 Dimensionally correct outlines, Item Number, and Description of all equipment on Contract Specifications and on Drawings.

1.3.4.8 Schedules of symbols and abbreviations.

1.3.4.9 Lateral and longitudinal dimensions of electrical receptacles / switches / junction boxes, water lines connections, waste line connections, floor sink/drains/troughs, and hood location and as required for rough-in of utilities by others. Floor sinks/drains located to be accessible, allowing easy removal of the grate, and located not to be in conflict with table legs, cabinet toe bases or other non-mobile equipment.

1.3.5 Product Data: Submit sets of bound brochures or specification sheets of standard items of equipment to be used on the project, inclusive of equipment contractor supplied / provided and owner / vendor supplied / provided equipment as specified and shown . Owner is responsible for providing information concerning any deviations from the specified equipment required by their acceptance of equipment varying from that which is specified and shown. Submit 6 sets for use by the contracting officer plus an additional quantity, determined by the contractor, for return and their use. The brochures or specification sheets shall be properly labeled and marked with item number, quantity, electrical wiring, all utility requirements, all accessories, finish, etc. Specification sheets shall be arranged in order by item number within the brochures.

1.3.6 Coordination With Owner Furnished Items: Where items are specified to be sized and/or calibrated to fit the owner's plates, dishes, cups, glasses, trays, etc., the contractor shall contact the owner directly to obtain the proper samples or sizes required.

1.3.7 Shop Drawings: The Contractor shall submit one (1) set of legible reproducible ozalid (sepia) prints and one (1) set of blueline prints of shop drawings of the proposed installation of food service equipment. Shop drawings shall include the items listed below.

1.3.7.1 Plan and Elevations: Include a plan and elevations of proposed piping and equipment to establish that equipment will fit allotted spaces with clearance for installation and maintenance. Show proposed details for attachment anchoring, and hanging to structural framing of building; vibration isolation units; foundations and supports; and location and size of sleeves for passage of pipes. The plan view and elevations shall be drawn at 1 inch equals 1 foot-0 inch scale with sections at 1-1/2 inches equals 1 foot-0 inch and special details at 3 inches equals 1 foot-0 inch. Submit fabrication drawings for non-standard. Fabrication drawings shall be at scale not less than 1/2" = 1'-0" and in full detail, complete with detail notes, materials listings with gauges, fixtures and fittings, finishes. Drawings shall accurately represent the equipment as it is to be fabricated including; dimensions for all sizes and locations; show all punched holes; all coves; edge, backsplash and rim configurations; all underbracing, mounting brackets, support brackets; legs, casters and crossrails; disposer and sink bowls; undershelves and elevated shelves; drawers and enclosures; dish table configurations; exhaust ducts; undercounter receptacles; joints; etc. as specified and as shown. Drawings shall be submitted rolled within a mailing tube fully protected for shipment. After approval this contractor shall print the number of prints as required for distribution.

1.3.7.2 Departures: Submit details of departures from Contract Plans that are deemed necessary by Contractor, including changes in related portions of project and reasons therefore. Where such departures require piping or equipment to be supported otherwise as shown than as shown, loading and type and kind of frames, brackets, stanchions or other necessary supports shall be detailed. Approved departures shall be made at no additional cost to the Government.

1.3.7.3 Electrical Diagrams: Submit for each piece of equipment having electrical components. Identify each component and show interconnected or interlocked components.

1.4 QUALITY ASSURANCE

1.4.1 Manufacturers' Qualifications: Firms regularly engaged in the manufacture of food service equipment of types, capacities, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 projects.

1.4.2 Contractor's Qualifications: Shall be firms regularly engaged in contracting for food service installations. They shall have successfully completed at least ten projects of similar size and magnitude as this project. They shall have the technical personnel to handle all phases of the work. They shall be able to demonstrate their financial ability to handle this project to the Owner's satisfaction.

1.4.3 Fabricators' Qualifications: Shall be firms regularly engaged in the manufacture of custom built food service equipment and who have a complete factory with suitable equipment, personnel and engineering facilities to properly draw, detail and manufacture the highest quality of food service equipment. All items of custom built equipment shall be fabricated by one fabricator. The workmanship shall be of the highest quality throughout and in accordance with the best accepted practices for this type of equipment.

1.4.4 Installer's Qualifications: Shall be a firm regularly engaged in food service equipment installations who has successfully completed installations of the same size and magnitude. Firm shall have expertise in field welding and finishing as well as being able to field adjust equipment to fit the project field conditions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design that conforms to the requirements specified.

2.2 CHROMIUM PLATING OF BRASS PIPE, VALVES, AND FITTINGS: Chromium plating of brass pipe, valves, and fittings shall conform to FS WW-P-541E.

2.3 COPPER TUBING: Copper tubing shall conform to ASTM B88, Type K or L, or ASTM B75, as appropriate for the application.

2.4 CORROSION-RESISTING STEEL AND STAINLESS STEEL: Corrosion-resisting steel and stainless steel shall conform to ASTM A167 and ASTM A240, Types 302, or 304.

2.4.1 Sound Deadening: Heavy-bodied resinous coating, filled with granulated cork or other resilient material, compounded for permanent, non-flaking adhesion to metal in 1/8" thick coating.

2.5 FITTINGS FOR COPPER TUBING: Cast copper alloy solder joint fittings shall conform to ANSI B16.18. Wrought copper and copper alloy solder joint fittings shall conform to ANSI B16.22. Cast copper alloy fittings for flared joints shall conform to ANSI B16.25. Fittings on tubing shall be of solder-joint type. Flared joint fittings may be used in specific applications when approved.

2.6 FITTINGS FOR BRASS PIPE: Fittings for brass pipe shall conform to FS WW-P-460, Class A or B, as appropriate for the application.

2.7 SILVER SOLDER: Silver solder shall conform to FS QQ-B-654, Class as appropriate for the application.

2.8 STRUCTURAL STEEL SHAPES FOR FRAMING: Structural steel shapes shall conform to ASTM A36/A36M. Structural shapes shall be uniform, ductile in quality and free of hard spots, runs, checks, cracks and other surface defects. Steel shall be galvanized by hot-dip process where such sections are specified to be galvanized. Surfaces shall be free of surplus spelter, runs, blisters, and uncoated spots or patches.

2.10 FABRICATION:

2.10.1 Welding:

2.10.1.1 Weld with welding rods of same composition as sheets or parts welded.

2.10.1.2 Make welds strong and ductile, free of imperfections such as pits, runs, spatters and cracks, and of same color as adjoining surfaces. Wherever discoloration of stainless steel occurs as result of welding, etc., the discoloration shall be polished out completely and the grain restored.

2.10.1.3 Make butt welds by welding straps under seams, filling in with solder, and grinding and polishing. Welded joints shall be homogenous with sheet metal. Do not substitute spot welding for full welding.

2.10.1.4 Weld joints in tops of counters, tables, drainboards, exposed shelving and sinks by an approved process other than one that will permit carbon pickup, such as carbon-arc welding.

2.10.1.5 Factory weld counter tops into lengths as long as practicable in order to reduce field welded joints. Wherever welds occur on surfaces not finished by grinding or polishing, coat welds and accompanying discoloration in factory with a metallic-base paint in such a manner as to prevent possibility of progressive corrosion of such joints.

2.10.1.6 Wherever a welding operation occurs on corrosion-resisting steel, possibility to corrosion shall be entirely eliminated. Bolts and screws may be welded by accepted process that will minimize possibility of carbide precipitation. Clean and coat welds in galvanized steel made after galvanizing, and adjacent areas where galvanizing is damaged, with galvanizing repair compound.

2.11 CHROMIUM PLATING: Apply over nickel plating.

2.12 GRINDING, POLISHING, AND FINISHING:

2.12.1 Grind exposed and unexposed welded joints with adjoining material and finish to match. Wherever materials have been depressed or sunken by a welding operation, hammer and peen flush depressions with adjoining surfaces. Avoid excessive heating of metal and metal discoloration in grinding operations. Use abrasives, wheels and belts in grinding free of iron and not have been used on carbon steel.

2.12.2 Remove grain of rough grinding. Texture of final polishing operation shall be uniform and smooth, to obtain a finish similar and equal to adjoining (undisturbed) metal areas.

2.12.3 Make butt and contact joints close fitting. Do not use solder as a filler. Make brake bends free of open-texture or orange peel appearance. Where brake work does mar uniform appearance of materials, remove marks by grinding, polishing and finishing. Sheared edges shall be free of burrs, projections and fins. Finish bullnose corners with under edge of material ground to a uniform condition. Do not overlap material.

2.12.4 Provide exposed surfaces of corrosion-resisting steel with a No. 4 finish. Finishes of materials other than CRES shall be substantially comparable in appearance to commercial mill finish. Exposed surfaces include:

2.12.4.1 Exterior surfaces exposed to view.

2.12.4.3 Interior surfaces exposed to view in door-type cabinets when doors are open, but not undersides of shelves. Unless a No. 4 finish is specifically required hereinafter, undersides of shelves have ground finish using a No. 80 grit or finer.

2.13 FASTENING DEVICES AND METAL FOR WELDING:

2.13.1 Use same material as metal being joint in joining pieces of similar metal.

2.13.2 Use corrosion-resisting steel when corrosion-resisting steel is joined to dissimilar metal.

2.14 BOLTS, SCREWS, AND RIVETS:

2.14.1 Exposed surfaces of equipment shall be free of bolt, screw, and rivet heads.

2.14.2 Wherever bolts are used to fasten trim to paneling and body of counters for tables to top angle framing, such bolts and screws shall be of a concealed type, corrosion-resisting steel of same composition as metal to which bolts and screws are fastened. Steel bolts or screws may be used in special cases, but only with permission of the Contracting Officer with a limit of 2 percent of total bolts and screws used. Coat steel bolts or screws when authorized for use, with a metallic coating suitable for protection against corrosion.

2.14.3 Wherever threads of bolts and screws occur on inside of fixtures and are either visible or might come in contact with a wiping cloth, cap bolt and screw threads with suitable lockwashers and chromium-plated brass or bronze acorn nuts. Where such screw threads are not visible or readily accessible, bolt or screw may be capped with a standard lockwasher and steel nut. Wherever bolts or screws are welded to underside of trim or tops, finish reverse side of weld uniform with adjoining surface of trim or top. Depressions at these points are not acceptable.

2.14.4 Pop rivet fasteners and exposed to view screws and bolts are not allowed.

2.15 PITCH AND DRAINAGE OF EQUIPMENT SURFACES: Wherever a fixture has a waste or drain outlet, pitch surface toward outlet. Pitch counters and drainboards 1 inch in 20 feet to drain.

2.16 SEALING: Wherever required, the sealing of backsplashes to walls, to cabinet bodies, to concrete or tile bases, roll-in refrigerators to floors or other types of application. Sealant shall be translucent Silicone Sanitary Sealant, or other approved ASTM C 920, Type S Grade NS, Class 25, use NT sealant which is an easily cleanable clear silicone sanitary sealant which does not support bacterial growth, Shore A hardness of 30. Backer rods of closed-cell polyethylene rod stock of a size larger than the joint width.

2.17 COUNTERS:

2.17.1 Countertops: Construct of 14-gauge corrosion-resisting steel, unless otherwise specified, with shop seams and corners welded, ground smooth and polished.

2.17.2 Counter Edges and Backsplashes: Provide type as specified or otherwise indicated on the drawings.

2.17.3 Counter Edges: At work tables, turn down 1-1/2 inches at 90 degrees and then back 1/2 inch on a 30 degree angle from horizontal.

2.17.5 Counter Edges: At dish tables, turn up 3 inches at 90 degrees on a 1/4 inch radius with 1-1/2" semi-rolled rim, terminate at back splash and weld thereto. Rolled rim shall have spherical corners.

2.17.6 Backsplashes: Turn up back edge 6 inches at 90 degrees on a 1/4 inch radius with top edge turned back 2 inches at 45 degrees with a raw edge

scribed and sealed to wall. Total height of backsplash shall be 8 inches. Ends of backsplash shall be welded closed.

2.17.7 Overhangs: Counter tops shall overhang cabinet base sections along the working sides and free ends or sides, not less than 2 inches.

2.18 COUNTER TOP SUPPORT CHANNELS: 14 gauge, 1 by 4 by 1 inch stainless steel channel. Provide under edges of counter top with cross members on 30-inch centers or less. Stud weld channels to counter top, or as specified.

2.19 COUNTER TOP SUPPORT ANGLES: 1-1/2 by 1-1/2 inch by 14 gauge stainless steel angles with corners mitered, welded and ground smooth. Provide cross members on 2-foot centers or less. Stud weld angle frame to counter top, or as specified.

2.20 COUNTER BASES: Open or closed as specified.

2.20.1 Closed Bases: Construct of 1-1/2 by 1-1/2 inch by 14 gauge stainless steel angles with corners mitered, welded and ground smooth. Provide horizontal and vertical angles on 2-foot centers or less. Provide enclosure panels of 18-gauge corrosion-resisting steel. Exterior vertical corners shall be square. All base cabinets shall be of all welded construction. All exposed joints in base cabinets, such as between headers and pilasters, aprons and pilasters, or any joint between vertical and horizontal members shall be integrally welded together with a flush one piece appearance on the exposed exterior, ground and polished.

2.20.2 Open Bases: Construct of 1-5/8 inch outside diameter, 16-gauge corrosion-resisting steel tubing with cross braces of 1-5/8 inch outside diameter, 16-gauge corrosion-resisting steel tubing integrally and continuously welded to legs. Provide cross braces to reinforce each leg. Legs shall be mounted by means of stainless steel cylindrical leg sockets welded to channels or angles. Rail bracing shall be omitted on the working side of the tables or counters.

2.21 SOCKETS: Corrosion-resisting steel, enclosed, a minimum 2-3/8 inches in diameter at top, reinforced with bushing and continuously welded to channel or angle, or attached as approved.

2.22 LEGS: 16-gauge, 1-5/8 inch outside diameter corrosion-resisting steel tubing, continuously welded to gussets, channel or angle as specified.

2.23 FEET: Sanitary die-stamped corrosion-resisting steel bullet shaped, enclosed, with a slightly rounded bottom. Fit top of feet with a male threaded stem of length so threads are not exposed to mate with end of legs, and provide for a 1-inch adjustment. Finish bottom of legs smoothly and overlap stem to provide a sanitary fitting.

2.24 CASTERS: Heavy-duty swivel type, 300 pound capacity, ball bearing, disc wheel, with replaceable grease-proof polyurethane tires. Minimum 5-inch diameter wheel with width of tire tread 1 inch. Provide pressure type grease fittings, thread guards and plated finish. Provide with lock or brakes. Casters shall be National Sanitation Foundation approved.

2.25 OPEN BASE STATIONARY SHELVES: Construct of 16-gauge corrosion-resisting steel with all free edges turned down 1-1/2 inches at 90 degrees on a 1/4-inch radius with bottom edges turned back 1/2 inch at 30 degrees from horizontal. Notch corners 90 degrees and intersections 180 degrees. Shelves shall be integrally and continuously welded to legs. Where undershelves abut an enclosed base the edge of the shelf shall be formed up 1-1/2 inches, tack

welded and sealed to the enclosed base. Undershelves shall be underbraced as specified for counter tops. Undershelves at 10" above finished floor per NSF standards.

2.26 OPEN BASE REMOVABLE SHELVES: Construct of 16 gauge stainless steel and in section sizes to allow cleaning them in dish machine. Roll edges down 1 1/2" fitting contour of cross rails, except where adjacent to walls, or other equipment then turn edge straight up 1-1/2" on 1/4" R. Turn adjacent edges of sections straight down 1-1/2" on 90^{o} angle.

2.27 DRAWERS: Drawer pans shall measure 20 by 20 by 5 inches deep. Drawer pans shall be molded of ABS thermoplastic with smooth interior finish. Interior vertical and horizontal corners shall be coved. Set drawer pan loosely in a channel frame so it can be lifted out for cleaning. Top edges shall be flanged out 1/2 inch. Welded channel support frame of 14-gauge corrosion-resisting steel. Weld drawer face to frame so that there will be no exposed screws or rivets on face. Drawer faces shall be constructed of 14 gauge stainless steel and shall measure overall approximately 23 inches long by 6-1/2 inches deep. The top of the drawer face shall be formed out horizontally approximately 7/8 inch and then mitered down on a 30 degree angle for approximately 1 inch, thus forming a full length drawer pull. Corners of the angled portion shall be mitered on a 45 degree angle. The drawer face shall fit tight against the drawer housing on all sides. Mount drawer slides on channel frame. Drawers shall operate on 14 gauge stainless steel full extension slides with stainless steel ball bearing wheels, positive stops and 200 lb. load capacity. Drawers shall be self closing. Provide stops for each drawer at fully opened position. Enclose drawers on open base tables in an 18-gauge housing of corrosion-resisting steel.

2.28 SOUND-DEADENING OF COUNTERS: Sound deaden counter tops with minimum of 1/8-inch thick approved hard-drying sound-deadening mastic material. Spray mastic onto surface after reinforcing members have been applied and provide smooth surface without dirt catching crevices. Paint deadening aluminum.

2.29 SINKS:

2.29.1 General: Construct to dimensions indicated of 14-gauge corrosion-resisting steel conforming to ASTM A167, Type 300. Round vertical and horizontal corners to a radius of not less than 3/4 inch with double walls at partitions. Score and pitch sink bottom to drain to waste outlet. Equip sinks with waste and overflow fitting, drain plug with quick-opening twist handle valve and faucets of type specified. Construct faucets, taps, valves and plugs of chrome-plated copper alloy or corrosion-resisting steel conforming to applicable requirements of FS WW-P-541E. Provide faucets, drain plug and overflow fittings for each sink compartment, unless otherwise indicated. Install spout outlet of faucets 4 inches minimum above rim of sink. Provide sink legs as specified for counters, except that closed gussets shall be welded to support channels. Anchor and seal sinks installed adjacent to walls or enclosures to walls or enclosure. Sound deaden sinks as specified for counters.

2.29.2 Drain Plug and Overflow Fittings: Drain plug shall consist of 2 inch quick opening rotary brass body valve with side outlet overflow connection, a corrosion-resisting steel rotary handle operator, and a removable perforated corrosion-resisting steel strainer plate of not less than 3 inches diameter. Overflow fittings shall consist of 1-1/4 inches diameter chrome-plated head in back of sink compartment. Provide overflow head with a removable perforated chrome-plated brass tubing of not less than 0.036 inch thickness connected to an overflow head in back of sink compartment and a removable perforated chrome-plated brass or corrosion-resisting steel strainer plate of not less

than 1-1/2 inches diameter. Specification is based on Fisher 22306 or 22322, overflow sized as required.

2.30 FAUCETS:

2.30.1 1/2" Backsplash-Mounted: Backsplash-mounted faucets shall be a single lever faucet with a rotating ball type mechanism with replaceable non-metallic seats operating in stainless steel lined sockets. Control handle shall always return to neutral position when valve is turned off. All exposed metal surfaces shall be chrome plated. Faucet shall have an 8 inch swing spout with a flow restricting pressure compensating aerator with 2.75 gpm maximum flow. Back splash mounted faucets shall have inlets at 7-3/4 to 8-1/4 inches on center and a chrome plated cover plate. Specifications are based on Delta Model #200 faucets.

2.30.2 Counter Top, 4" Centers Deck-Mounted: Countertop, deck mounted work board faucet shall consist of a swivel 8" reach spout centered behind the sink with 4" centers double valve body with lever handles. Bronze body, removable seats, 6-1/2" x 2" wide chrome plated escutcheon, 1-1/2" long shanks, 1/2" IPS threads. Spout shall have a flow restricting pressure compensating aerator with 3.0 gpm maximum flow. All exposed metal surfaces shall be chrome plated. Specifications are based on T&S Model #B-1111 faucet.

2.30.3 3/4" Back Splash Mounted: 3/4" backsplash-mounted faucet with high volume water capability. Shall be a double valve, open body faucet with 12" swing nozzle, 8" centers, 3/4" IPS inlets; four arm handles. Capable of flowing 31 GPM with both hot and cold sides open at 20 psi water pressure. Specifications are based on T&S Model #B-0290 faucet.

2.30.4 Overhead Pre-Rinse Spray: Provide spring type pre-rinse spray, centered behind disposal / sink with spray head centered over disposal or sink. Single hole deck mount double valve control, flexible stainless steel hose wrapped with stainless steel support spring with wall bracket(s) to adjacent walls (Two required when located in a corner). Specification based on T & S Brass Model B-0113-B

2.31 OTHER PLUMBING FIXTURES: Other plumbing fixtures, such as drinking water dispensers are specified in SECTION 15400, PLUMBING.

2.32 HOODS AND DUCTS:

2.32.1 General: Hoods and ducts shall conform to NFPA 96. Provide hoods and grease removal devices over cooking equipment, such as, but not limited to, deep fat fryers, ranges, griddles, and broilers, with fixed pipe fire suppression system and provide with portable fire extinguishing equipment in accordance with NFPA 96, subparagraph: Fire Extinguishing System. Unless otherwise specified, secure equipment to building in an approved manner and installation to be free from vibration under conditions of operation.

2.32.2 Grease Extracting Exhaust Hoods Over Cooking Equipment: Factory fabricate and assemble with built-in fire protection, high-velocity type with a throat opening above and adjacent to cooking surface, to extract grease and other contaminants from exhaust air. Grease extractors for exhaust hoods shall conform to UL and be the size and type shown on the plans.

2.32.3 Material and Fabrication: Not less than 18-gauge corrosion-resisting steel for exterior parts exposed to view. Continuously weld exterior joints with welds ground and polished to match adjacent finish. Provide two hoods of approximately equal length suitable for mounting end-to-end, when hoods are more than 10 feet long. Overhead canopy-type hoods shall be suitable for wall

mounting. Hoods shall be supported with factory installed hanger rods from ceiling, and be provided with wall-mounting brackets.

2.32.4 Fire Extinguishing System: Provide each exhaust hood or groups of hoods served by a separate blower with a fire extinguishing system that shuts off exhaust blower. Provide fire extinguishing system in accordance with NFPA 96. Activate fire extinguishing system by fusible links located in each hood. Activate each fire extinguishing system by a single remote fire switch mounted as shown on drawings.

2.32.5 Equipment Approval: Field installed fire extinguishing equipment for protection of cooking surfaces shall be UL listed or FM approved for that service. Field installation shall include remote stations, service piping from containers holding fire extinguishing agent and cylinder release mechanism in a stainless steel cabinet.

2.32.6 Exhaust Blower Capacity: Exhaust blower and make-up air capacity shown is based on an exhaust hood air requirement relative to the equipment beneath the hood and the U.L. test listing of the hood manufacturer. If hood provided varies in air requirements or static pressure by more than 5 percent from shown requirements, resize fan and exhaust ductwork to accommodate hood provided. Base duct size on a minimum velocity of 2,000 feet per minute. Exhaust blower shall conform to NFPA 96.

2.33 DUCT AT DISHWASHING MACHINES: Provide and install two vertical ducts, one at each end of dishwasher. Construct exposed ducts of not less than 18-gauge corrosion-resisting steel and size to accommodate machine exhaust vent. Install intake of each duct at top edge of dishwasher and connect exhaust outlet to exhaust system.

2.34 GAS BURNING EQUIPMENT:

2.34.1 American Gas Association (AGA): Design gas-burning equipment for operation with type of gas specified and as approved by AGA. Acceptable evidence of meeting requirements of applicable AGA standards shall be one of the following:

2.34.1.1 A photostatic copy of the AGA appliance certificate.

2.34.1.2 A listing of specific food service equipment or appliance in AGA Certified Appliances and Accessories Directory.

2.34.1.3 A certified test report from a recognized independent testing laboratory, acceptable to Contracting Officer, indicating that specified food service equipment or appliance has been tested and conforms to requirements of applicable AGA standards.

2.34.2 NFPA Standards: Install equipment in conformance with NFPA 54.

2.34.3 Gas Valves, Quick Disconnect and Flexible Connectors: Quick disconnect and flexible connectors for each installed gas burning appliance or piece of food service equipment connected to building piping is furnished within this section.

2.35 GAS PIPING: Connections to gas piping shall conform to requirements of NFPA 54 and SECTION 15488, GAS PIPING SYSTEMS.

2.36 PLUMBING: Connections to domestic water and waste piping shall conform to UPC or NAPHCC 01 and SECTION 15400, PLUMBING.

2.37 ELECTRICAL WORK:

2.37.1 General: Provide motors, manual or automatic motor control equipment and protective or signal devices required for operation specified herein in accordance with NFPA 70 and SECTION 16050, ELECTRICAL. Provide wiring required for operation specified herein, but not shown on electrical plans in accordance with SECTION 16050, ELECTRICAL.

2.37.2 Installed Equipment Load: Should equipment differ from that specified as approved for use, and such equipment has different load requirements from that specified, provide electrical service compatible with installed equipment loads.

2.37.3 Conformance to UL and NEMA Standards: Electrically operated equipment shall be in accordance with applicable standards of UL Electrical Appliance and Utilization Equipment Directory and UL 197, wherever standards have been established by that agency. Acceptable evidence of meeting requirements of UL shall be UL label, a UL listing mark, or a certified test report from a recognized independent testing laboratory, acceptable to Contracting Officer, indicating method of testing and a statement that components have been tested and conform to applicable UL standards. Electrical enclosures shall conform to NEMA ICS 1 and 6. Electrical wiring devices shall conform to NEMA WE 1.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install equipment in accordance with requirements of these specifications, the plans, and the manufacturer's written installation instructions.

3.1.1 Installation: Set each item of non-mobile and non-portable equipment securely in place, level, and adjust to correct height. Anchor to supporting substrate where indicated and where required for sustained operation and use without shifting or dislocation. Conceal anchorages where possible. Adjust countertops and other work surfaces to level tolerance of 1/16 inch maximum offset, and maximum variation from level or indicated slope of 1/16 inch per ft. Where indicated or required for safety of equipment operator, anchor equipment to floor or wall. Where equipment is indicated to be anchored to floor, provide legs with adjustable flanged foot. Install 2 anchors on each foot.

3.1.2 Field Joints: Complete field-assembly joints in the work (joints that cannot be completed in shop) by welding. Grind welds smooth and restore finish.

3.1.3 Enclosed Spaces: Treat spaces that are inaccessible after equipment installation by covering horizontal surfaces with powdered borax at rate of 4 oz. per sq. ft.

3.1.4 Closure Plates and Strips: Install where required with joints coordinated with units of equipment.

3.1.5 Cutouts: Provide finished smooth cutouts in food service equipment where required to run plumbing, electric, gas, or steam lines through equipment items for final connections.

3.1.6 Sealants and Gaskets: Install all around each unit to make joints airtight, watertight, vermin-proof, and sanitary for cleaning purposes. In general, make sealed joints not less than 1/8 inch wide, and stuff backer rod to shape sealant bead properly, at 1/4 inch depth. Shape exposed surfaces of

sealant slightly concave, with edges flush with faces of materials at joint. At internal-corner joints, apply sealant or gaskets to form a sanitary cove, of not less than 3/8-inch radius. Provide sealant-filled or gasketed joints up to 3/8 inch joint width; metal closure strips for wider joints, with sealant application each side of strips. Anchor gaskets mechanically or with adhesives to prevent displacement.

3.2 PROTECTION AND CLEANING: Cover equipment and fixtures and protect against dirt, water and chemical, or mechanical injury. Clean and deliver equipment and fixtures in a condition satisfactory to Contracting Officer at completion of work.

3.3 TESTING: Inspect and test equipment under operating conditions after installation, unless otherwise specified. Test each item of operational equipment to demonstrate that it is operating properly and that controls and safety devices are functioning. If inspection or test show defects, correct defects and repeat inspections and tests.

3.4 CLEANING: After completion of installation and other major work in food service areas, remove protective coverings, if any, and clean food service equipment, internally and externally. Restore exposed and semi-exposed finishes to remove abrasions and other damages; polish exposed-metal surfaces and touch-up painted surfaces. Replace work that cannot be successfully restored. Prior to date of partial occupancy on food service equipment work, buff exposed stainless steel finishes lightly, using power buffer and polishing rouge or grit of No. 400 or finer. After testing and start-up, and before time of partial occupancy, clean all food service equipment and leave in condition for owner's sanitizing procedures prior to use in food service.

3.5 CLOSEOUT PROCEDURES: Provide services of Installer's technical representative, and manufacturer's technical representative where required, to instruct Owner's personnel in operation and maintenance of food service equipment. Schedule training with Owners representative; provide at least 7-day notice to Owners representative of training date.

3.6 EQUIPMENT AND FIXTURES:

3.6.1 General: Furnish and install equipment fixtures, specified herein, complete with trimmings, ~~steam traps~~ and fittings necessary for proper operation of equipment, and unless otherwise specified under item requirements for pre-production, samples will be waived. Equip burners located in enclosed compartments, with automatic pilots that automatically close off the gas to burners, including pilot burners, if means of ignition becomes inoperative. Provide a complete set of special tools with each unit for adjustment, inspection or service to equipment.

3.6.2 Equipment and Fixture Connections: Exposed condensate, gas, water and waste piping including plumbing traps, shall be chromium-plated copper alloy. Piping not exposed shall conform to that specified in other sections. Except where otherwise specified, provide power cord lengths as specified in referenced federal, military, or manufacturer's specification.

3.7 EQUIPMENT NAMEPLATES AND IDENTIFICATION PLATES:

3.7.1 Provide each item of equipment with a corrosion-resisting steel or approved polyester nameplate or identification plate, as standard with manufacturer, located in a conspicuous position and fastened to equipment by rivets or other permanent fastening devices, in accordance with applicable portions of MStd 130.

3.7.2 As a minimum, nameplates or identification plates shall reflect:

3.7.2.1 Name of manufacturer.

3.7.2.2 Make and/or model number.

3.7.2.3 Pertinent ratings, operating characteristics and other information as standard with manufacturer.

3.7.2.4 Date of manufacture.

3.7.2.5 Electrical characteristics.

3.7.2.6 Other applicable data, such as flow rate, temperature, pressure capacity and material of construction.

3.7.3 Provide separate equipment identification plates with construction contract number marked thereon, to be fastened to surface of each piece of equipment. Identification plate shall be as permanent as life expectancy of equipment on which affixed.

PART 4 REFRIGERATION EQUIPMENT:

4.1 GENERAL: Condensing units shall be factory assembled, piped, wired, tested and run. Condensing units shall be mounted on a metal frame and shall include accessible hermetic motor compressors with built in thermal overload, suction and discharge stop valves, oil sight glass, and suction and discharge line vibration isolators as required, factory installed and braced. Units shall have an air cooled condenser with copper tubes and aluminum fins arranged for horizontal air flow with direct driven propeller fans and motors with built in overload protection. Units shall also be equipped with a refrigerant receiver with purge, charge and relief valves with seal caps.

4.2 EVAPORATORS: Evaporator units shall be as specified and shall be ceiling suspended with nylon bolts and mounted as shown on drawings. The evaporator housing shall protect the refrigerant piping against damage. The evaporator shall be mounted to ensure complete drainage from defrost or the refrigerant piping. Fan guards shall be supplied and shall be OSHA approved.

4.3 CONTROLS: Control of each refrigeration system shall be by automatic recycling pump down cycle by means of a solenoid valve in the liquid line of each system operating by a thermostat with remote bulb in the return air to an evaporator unit. The thermostat shall be suitable for use within the refrigerated space.

4.4 REFRIGERANT PIPING: Piping of refrigerant and condensate piping shall be copper tubing, hard drawn, type "L", ACR nitrogen filled and sealed. Fittings for refrigerant lines shall be forged or wrought copper, assembled using silver solder. The suction lines shall be sized to give a maximum pressure drop from the condensing unit to the evaporator unit of two pounds for medium temperature systems and shall allow gas velocities of not less that 750 feet per minute in horizontal runs and 1500 feet per minute in vertical risers. Liquid lines shall be sized to give a maximum pressure drop of three pounds from receiver to the evaporator units.

4.5 PIPING HANGERS: Furnish and install adjustable hangers, anchors or straps for all refrigerant piping. Hangers shall be spaced not to exceed ten feet on centers and closer where required for the expansion and contraction of

pipe lines. Hangers shall permit screw adjustment after erection of the piping. Insulated refrigerant lines shall be provided with approved protective sleeves at hanger points.

4.6 INSULATION: All refrigerant suction lines shall be insulated back to the condensing units with Armstrong Armaflex foamed plastic insulation with flame spread rating of 25 or less and smoke developed rating of 50 or less as tested by ANSI/ASTM E84 (NFPA 255) method. Insulation shall be applied in accordance with the manufacturer's directions. The minimum thickness of the insulation on refrigerant piping shall be 1/2 inch for medium temperature units and 3/4 inch for low temperature units. All insulation that is outdoors and exposed shall be covered completely with plastic sleeving secured and sealed in place.

4.7 TESTING: After refrigerant piping has been run, but before it is insulated, each system shall be run and tested for leaks. If there are no leaks then the contractor shall connect a rotary vacuum pump to the gauge port of the compressor discharge service valve with copper tubing or vacuum hose if not less than 3/8 inch diameter. With the compressor suction and discharge valves open, the vacuum pump shall be operated until a vacuum of 1500 microns absolute is obtained. The vacuum shall then be broken with dry nitrogen and the system evacuated again to 1500 microns. The vacuum shall again be broken with dry nitrogen and a third evacuation to 500 microns shall be made. The motor compressor shall not be operated while the system is under a vacuum and shall not be used as a vacuum pump to evacuate the system. The contractor shall then charge each system with the correct type and amount of refrigerant as shown in the manufacturer's instructions. The motor compressor must be operating while the charging is being done.

4.8 START-UP: The start-up, testing and placing into operation of this equipment shall be supervised by a qualified refrigeration installer.

4.9 WARRANTIES: All equipment shall be warranted against defects in workmanship and material and all repairs and replacement which may become apparent and necessary by reason of such defects during the first year after final completion and acceptance of the equipment installation will be made by the contractor at his own cost and expense and without charge to Owner. All repairs and replacements shall be made at a time and during hours satisfactory to the Owner. All self contained or remote refrigeration systems furnished under this contract shall include start up and testing and temperature adjustment. The systems shall have a one year guarantee, 5 year compressor warranty and a one year refrigeration service policy. The service policy shall be maintained on a local level and shall include all labor, material, refrigerant and mileage.

PART 5 ITEM SPECIFICATIONS:

ITEM #1 - 2110 LB. Capacity Elevated Ice Bin & Buggies:

One only elevated 2110 lb. bin w/ Two ice transport carts. Elevated bin, front ice discharge chuted, storage bin, and cart systems use gravity to load ice into cart, 72"W. X 40"D. X 75.5"H. Exterior finish of bin and base to be full stainless front sides, back and bottom. Bin liner is seamless heavy-duty non-corroding polyethylene; bin insulated non-cfc polyurethane foam; stainless steel bin top and custom cut to icemaker; lower door assembly to include non-corroding poly snout, poly lift door which eliminates gasketing and latches, and inner gate to control ice flow in snout; double wall poly upper inspection door. Parking below the elevated bin, snout empties into mobile stainless steel ice transport carts w/ hinged plastic lid and drain. Cart includes; 23"W.; oversized back wheels; three removable 25 lbs rectangular totes of one-piece molded poly w/ swivel handles.

Provide with 2nd cart with totes.

Provide with special top to support 1000 lbs+ of cubers. Configure top for cubers Items No. 23 & 24.

Specification based on Follett DEV2100SG-72-75 elevated 2110 lb. ice bin w/ Two SmartCART 75 ice transport carts.

Item #2 - Relocate (1) Section Glass Door Condiment Refrigerator:

One only relocate Manitowac model CRG1, 115V 1ph 6 amps, overall 26"W x 32"D x 83 3/4?H on casters, stainless steel interior and exterior. Wired for 115V, 1Ph, 6 amps.

Item #3 - Relocate S/S Semi-Enclosed Base Beverage Counter W/ Urn Drain, Dbl. Under Shelves, Sink:

One only relocated beverage counter overall 12' 1/4"L x 31"D x 34"H to the work top. 7?H x 1" flat top backsplash. Divided into Two units; left end is 72" L right end is 72"L. Left end has 69 ?" L urn drain centered at 5" from the front bottom and intermediate undershelf. All stainless steel construction. Right, second unit has 16"W x 20" front to back x 10"D sinks centered at 10 ? from the left end. 4" centers deck mount faucet needs replacing. 52" L enclosed base with intermediate and bottom shelf at right end. Structure enclosure below sink needs substantial clean up. Appears to have had a removable closure panel on the front of the sink, 20"W x 26 1/4"H. Panel is missing.

Provide new Counter Top 4" Centers Deck Mounted faucet.

Provide new Standard rotary drain valve w/ 6" tail piece.

Clean of all grease and residue

Item #4 - Relocate Approx. 30" x 72" S/S Coffee Brewing Table W/ Under Shelf:

One only relocate coffee brewing table overall 72" x 30"D all stainless steel with welded undershelf, bull nosed radiused edge all sides of top. 36"H to the top.

Item #5 - High Speed Twin Ten Gallon Urn Coffee Brewer:

One only Twin 10 gallon fully automatic coffee urn capable of simultaneously brewing on both sides with two spray arms and each spray arm shall be controlled by its own timer. Dual wall fiberglass insulated , stainless steel construction, positive low water cutoff system, automatic refill, automatic air agitation with plug in type top coffee gage fittings. One year parts and labor warranty included. Wired for 208V, 3PH, 42 amps. Urn to be hooked up to 140? 160? hot water. Required connection to separate 120 volt supply. 6" cord and plug supplied.

Specification based on American Beverage Systems model 87710.

Item #6 - Not Used

Item #7 - Not Used

Item #8 - Not Used

Item #9 - Relocate Shelving Unit:

One only relocate Metro 48" X 24"D x 77 ?"H on 6" casters, has 6 stainless steel vented shelves.

Item #10 - Removable Mat Shelving Units (for decanter / pitcher storage) (3 Only):

One only (1) unit, (5) shelves high, (4) posts, 24"W. X 36"L. x 74"H, with removable polypropylene mats, epoxy coat steel frame, clamping - easy adjust shelf position locks. Provide with (4) - 5" heavy duty swivel stem casters with donut bumpers, Two with brakes. Specification based on MetroMax Q? Starter Shelving Unit model 5Q557G.

Two only (2) units, (5) shelves high, (4) posts, 24" W, 48" L, 74" H, with removable polypropylene mats, epoxy coat steel frame, clamping - easy adjust shelf position locks, Provide with (4) - 5" heavy duty swivel stem casters with donut bumpers, Two with brakes. Specification based on MetroMax Q? Starter Shelving Unit model 5Q537G,

Item #11 - Security Cage Liquor Storage Shelving (4 Only):

Four only stationary security unit, 27 1/4"W. x 50-1/2"L. x 66 13/16"H. Chrome plated heavy gauge wire units allow visibility to contents, hinged double doors, full height locking bar with padlock at mid point, adjustable intermediate shelves. Provide with the following options;

Provide each unit with Three (3) intermediate shelves (total of 12 req?d)

Four (4) foot plates in lieu of standard leveling bolts. Anchor each foot to the floor with (1) steel expansion sleeve anchor.

Specification based on InterMetro Industries Corporation Model No. SEC55CQ with 2448QBR shelves and 9993Z foot plates .

Item #12 - (3) Section Reach-in Refrigerator W/ Glass Doors:

One only (3) section glass door refrigerator, self-contained refrig. system, aluminum exterior and interior, s/s floor, cam-lift hinged glass doors, top mount compressor, 6" casters (3 w/brake). Wired for 115V, 1PH, 3/4hp, 15.3 amps.

Provide (6) extra wire shelves (total 15 shelves).

Specification based on Manitowac model KR-3GD

Item #13 - Relocate Approx. 30" x 96" S/S Semi-enclosed Base Table W/ Dbl. Shelf Left, (3) Drawer Bun Warmer, (3) Shelf Right:

One only overall 96"L x 31"D x 34 ?"H to the work top all stainless steel construction, left end has 38"L double undershelf, right end has 22"L triple undershelf area, at middle is double Toast Master Warming drawer model 3880A, 115V, 1 KW. Has H joint connector to pass thru through window S/S sill. Back and sides of unit are soiled and have paint over spray . Wired for 115V, 1PH, 1KW.

Overlay top with new top having a back splash.

Item #14 - Relocate 200 Covered Plate Banquet Cabinets (2 Only):

Two only relocate Carter Hoffman model FH90-0015B, 120V 13.7 amps 1651 watts. Overall 61"W x 30 ?"D 71"H. Wired for 120V., 1PH, 13.7 amps.

Item #15 - 200 Covered Plate Banquet Cabinet:

One only provide for stacked plate w/ covers, mobile, high density fiberglass insulation, dutch door for pre-plated food, w/thermostatically controlled heat unit, capacity 200 without carriers, s/s construction, without plate carriers, 120v, 1600w, 14amps, 60hz, 1ph

Specification based on Carter Hoffman model BB-200D.

Item #16 - Dbl. High 10" x 72" Wall Shelves:

One only provide and mount on wall, constructed per standards for Elevated Shelves, Two (2) 10"d. x 6'-0"L. wall shelves, at 18" and 30" above table top, set on S/S wall brackets, with raised inverted "V" edge perimeter and standard turndown edge with toe-in on all exposed sides, turn up adjacent wall 2" at back, securely anchored to wall.

Item #17 - Coffee Decanter / Satellite Canister Warmers (4 Only):

Four only relocate Brewmatic / Farmer Brothers satellite stove warming stations, 120V., 140W., 1.2A. with cord and plug.

Item #18 - Tea Brewer:

One only Relocate Farmers Brothers T2000, model 2000500, 120V 1ph 1520 watts. Overall 10"W X 21 1/4"D x 28 ?"H on 4 ?" legs. Wired for 120V, 1PH, 12.7 amps.

Item #19 - 24" X 48" Condiment Storage Shelving:

One only provide (5) shelves, (4) posts, 24" W, 48" L, 74" H, with removable polypropylene mats, epoxy coat steel frame, clamping - easy adjust shelf position locks. Provide with (4) - 5" heavy duty swivel stem casters with donut bumpers, Two with brakes. Specification based on MetroMax Q? Starter Shelving Unit model 5Q557G.

Item #20 - Dbl. High 10" x 96" Wall Shelves:

One only provide and mount on wall, constructed per standards for Elevated Shelves, Two (2) 10"d. x 8'-0"L. wall shelves, at 18" and 30" above table top, set on S/S wall brackets, with raised inverted "V" edge perimeter and standard turndown edge with toe-in on all exposed sides, turn up adjacent wall 2" at back, securely anchored to wall.

Item #21 - Hand Sink w/ Soap & Towel Dispenser (3 Only):

Three only provide overall 15-1/2"W. x 16-1/2"D. X 30"H. 304 stainless steel; integrally welded and polished one-piece die formed 12"W. X 10"D. X 6"H. bowl; inverted ?V? no drip edge with turn down and toe-in at exposed sides; 7"H. Integrally formed backsplash. Includes; mounting bracket, stainless steel

basket type drain; C-fold towel dispenser with hinged cover and soap dispenser; chrome plated splash mounted 4" O.C. gooseneck faucet. Provide with the following options;

Wrist action faucet handles in lieu of standard.

Chrome plated P trap with tail piece.

Specification based on Universal Stainless model No. CHS-3*M112,

Item #22 - Not Used

Item #23 - Relocated 640 lb Prod. Ice Cuber:

One only relocate Manitowac model QD0802A ice cuber. Aired cooled, having an ARI-certified ice production capacity of 640 lbs per 24 hrs. at 90° F. air and 70° F. water temperature, overall size of cuber 30"W. X 24.5"D. X 26.5"H. . dice cube size. Features self cleaning / self sanitizing technology; dishwasher safe aluminum mesh condenser air filter; ice thickness control; R-404A refrigerant; stainless steel exterior; corrosion free base. (3) year parts and labor warranty; (5) year parts and labor evaporator warranty; (5) year parts and (3) year labor warranty on compressor. Back flow prevention device as required by code to be provided by others. Wired for 208-230V, 1PH, 15.1 amps.

One only relocate Manitowac Tri-liminator dual cartridge filtration system w/ pre-filter. Tri-liminator*M112 water filter. Consists for Two primary filters and One pre-filter. Primary filters; 80 PSI max. pressure, 125° max. temperature, 1.5 GPM, FDA grade polypropylene filter housing, 25 microns primary filtration, filter comprised of 2.5 sq. ft. spun polypropylene, 4 oz. food grade phosphate scale inhibitor crystals, 23 oz. food grade activated carbon. Pre-filter; 5 micron filtration through spun polypropylene. Galvanized steel mounting assembly with white powder coat paint.

Item #24 - 830 Lb. Prod. Ice Cuber:

One only provide air cooled, having an ARI-certified ice production capacity of 830 lbs per 24 hrs. at 90° F. air and 70° F. water temperature, overall size of cuber 30"W. X 34"D. X 79.5"H.. 7/8" square cube size. Features self cleaning / self sanitizing technology; dishwasher safe aluminum mesh condenser air filter; ice thickness control; R-404A refrigerant; stainless steel exterior; corrosion free base. (3) year parts and labor warranty; (5) year parts and labor evaporator warranty; (5) year parts and (3) year labor warranty on compressor. Back flow prevention device as required by code to be provided by others. Wired for 208-230V, 1PH, 14.3 amps. Specification based on Manitowac model QD-1002A.

Mounted in an accessible location on the back wall, provide water filter. Consists for Two primary filters and One pre-filter. Primary filters; 80 PSI max. pressure, 125° max. temperature, 1.5 GPM, FDA grade polypropylene filter housing, 25 microns primary filtration, filter comprised of 2.5 sq. ft. spun polypropylene, 4 oz. food grade phosphate scale inhibitor crystals, 23 oz. food grade activated carbon. Pre-filter; 5 micron filtration through spun polypropylene. Galvanized steel mounting assembly with white powder coat paint. Specification based on Manitowac model Tri-L-25N Tri-liminator.

Item #25 - Beverage Cooler:

One only furnish all labor, materials, and equipment for complete installation of sectional walk-in refrigerator unit as shown on drawings and specified

herein. Shall include lights, thermometers, time clock, expansion valves, solenoid valves, temperature control, sight glass, drier , head pressure control, crankcase heater, anti-sweat heater, cables, pilot lights, evaporators, outside condensing units, accessories and all other required parts and refrigeration specialties for complete first class installation. Refrigerants shall be in compliance with the Montreal Protocol for reduced CFC content; refrigerator using R-22. Install compressor, refrigerant piping and refrigerant as specified, hereinafter. See refrigeration requirements paragraph of these specifications.

Walk-in box N.S.F. approved.

Design layout and overall size of walk-in units as shown on plans and as specified. Shall be overall size 9'-6" wide x 8'-0" long x 8'-7" high from exterior top to bottom of pre-fab floor. Each compartment being completely free of other for use and operation. Unit shall be installed on an existing supported slab, see detail on drawings.

Refrigerator shall operate at 38^{o} F.

Provide walk-in with 4" insulated floor designed to with stand uniformly distributed loads of minimum 600 lbs per square foot. Floor underside 26 gauge smooth galvanized steel. NSF interior floor of 0.100 smooth aluminum. Coordinate walk-in installation with General Contractor. Provide floor panels in maximum lengths and widths to minimize joints and avoid mid floor panel corners.

Installed over the top, provide a floor wear surface of .188" 6061-T6 mill finish aluminum tread plate meeting ASTM B642. Joints in tread plate shall be staggered, offset from insulated floor panel joints by minimum 18". Secure tread plate to insulated panels per manufacturers recommendations. Tread plate / floor panel construction shall support minimum 400 lb point loading from casters.

Interior Ramp shall match the interior of door, depth 19 ?" from inside of door threshold with incline angle of 11 ? degrees. Construction shall include a foamed-in-place, 22 gauge type 304 stainless steel with heavy underlay to support top wear surface. Non-skid strips for safety.

Construct all exterior and interior surfaces of 0.040 embossed aluminum. Insulate walk-in throughout, with 4" foamed-in-place, rigid U.L. fire rated, 100% foamed-in-place polyurethane insulation 4" thick, UL Class 1, bonded by an adhesive to the interior and the exterior metal pan skins and heat cured. Panels are 6" increments, with a minimum width of 6" and a maximum width of 48"; cam lock type fasteners are used as joining devices: each skin formed using 90? bend on each edge; All panels are U.L. label. Panels joints are interlocking male and female tongue and groove shapes; panel edge shall have a gaskets which provide a positive seal that meets NSF standards; flame spread rating according to ASTM E-84/UL 723 shall be less than 25 and a smoke rating not exceeding 450. "R" factor of 33. Food service contractor shall provide penetrations thru insulated cabinet exterior & is responsible for sealing them.

On exposed-to-view exterior of walk-in box panels and doors, and on interior side of doors, provide 1/8" x 36"H. aluminum tread plate wainscot mechanically secured and sealed thereto.

Door shall be in-fitting, flush design w/ minimum 36" opening width by 78"H. in a 48" panel. Door section shall provide a full 4 inches of polyurethane, HFC-134a insulation construction and finish shall be same as the adjoining wall panels. Bottom of door shall seal with an adjustable double sweep

gasket, to provide complete seal between door threshold and door jamb. Door jamb shall be a fully coved, extruded welded, structural anodized aluminum. Threshold plate shall be constructed of extruded aluminum for bearing weight. Doors on rooms operating at below 35?F. shall have an anti-sweat heater wire around entire perimeter of door opening and under threshold; door swing as indicated on drawings.

Door hardware shall be high pressure die-cast zinc with a polished chrome finish.

Provide 4" dial thermometer with accurate temperature sensing from -40? to +60?F.; with both Fahrenheit and Centigrade scales; 5' capillary sensing tube; calibration adjustment screw.

Dead Bolt Lock required. Outside the dead bolt lock shall be operated by a key and shall have an inside safety release. Provide (5) keys.

Lighting: Provide an incandescent vaporproof gasketed UL listed light fixture, made of cast aluminum with a Lexan globe. Light includes constant burning night light. Light mounts at interior strike side of door panels section. Light switch w/ pilot light adjacent to door on exterior is pre-wired to interior door section mounted light with concealed wiring in conduit within insulated panel. All light fixtures shall operate on 115 VAC.

Provide 75 watt bulbs for all fixtures.

Structurally design ceiling sections to span area shown, without dip or bulge, in horizontal planes and provide exterior ceiling suspension beams where required.

Ceiling panels: 4? thick with one piece foamed-in-place edge caps. Metal face skins are to incorporate seams using a double 90? bend at maximum width of two feet for additional strength. The joint between the ceiling and wall shall form a 45? angle. Ceiling topside 26 gauge smooth galvanized steel,

Provide vertical flat and angle strips of same material and gauge as walk-in exterior wall surface, where walk-in is adjacent to walls and/or columns. Crimp all angle trim strip edges down slightly, to hug adjacent surfaces. Attach trim strips with 1/8" aluminum pop rivets, using only minimum required number to give neat installation.

Provide removable closure panels of same material and gauge as walk-in exterior wall surface, at exposed edges of walk-in top, as shown on the drawings, to finish ceiling at 10'-0". Panels fit snugly in top and bottom channels providing a straight and uniform appearance without gaps, tin-panning and irregularities.

Provide pre-fitted remote refrigeration system for remote installation set on the facility roof, including all standard parts, refrigeration specialties, factory sized refrigeration lines, air cooled condensing unit, with weather-proof cover and low ambient kit/winter control using head pressure control valve and other items necessary for a complete and properly operating system. Hang evaporators with nylon bolts. Provide (5) year compressor warranty.

Provide refrigerator with 6528 BTU/Hr. capacity pre-fitted remote semi-hermetic welded hermetic refrigeration system with 1 horsepower condensing unit and matched evaporator coil for refrigerator to operate at 35^{o} F. Condensor wired for 208V, 3PH,1hp, 15A circuit. Evaporator 115V, 1PH, 15A circuit.

Weather proof cover shall provide protection from hail.

Condensing units shall be set on the roof top above the walk-in location, set on curbs provided by others (ref. mech.). All refrigerant lines shall be sized for distances shown, for proper operation.

Extend evaporator condensate drains to floor sink as shown. Extend drain lines with cooper tubing having minimum diameter of 5/8" radius per manufacturers recommendations. Run lines as shown with minimum slope of 1/4" per foot.

It is the intention of this specification for a complete refrigeration system, including all refrigeration specialties and all other parts, devices and accessories required for a complete and properly functioning system, furnished and installed whether or not each item is specifically mentioned in the specifications.

Specification based on Norlake walk-in with 6528 BTU/Hr. capacity pre-fitted remote semi-hermetic refrigeration system with 1 horsepower condensing unit and matched evaporator coil for refrigerator to operate at 35^{o} F.

Item #26 - Single Tier Pallet:

One only provide, constructed with hi-tensil extruded 1-1/2" x 1-3/4" x .070 wall aluminum tube, all heli-arc welded, feet capped, 2,000 to 4,000 lb. average weight capacity, 24" x 48" x 8"H.

Specification based on New-Age model 2015.

Item #27 - Double Tier Pallet (4 Only):

Four only provide, constructed with hi-tensil extruded 1-1/2" x 1-1/2" x .070 wall aluminum tube, all heli-arc welded, NSF adjustable feet, 1,500 lb. average weight capacity per shelf, each unit 48"H. X (2) shelves high. Provide the following;

Two (2) units 24"W. x 36"L. x 48"H.

Two (2) units 24"W. x 48"L. x 48"H.

Specification based on New-Age All Welded Shelving, Bar Style, models 1025 and 1026.

COOKING EQUIPMENT

Item #100 - 72" Gas Charbroiler:

One only provide cabinet base floor model radiant charbroiler, overall 72"W. x 33-3/4"D. X 36"H. Full insulated double walled sides, back and bottom; S/S outer sides, front and service shelf; free floating 1/2"Dia. cold-rolled steel rod top grid; tilt up top; S/S "V" shaped radiant located above each burner. 3/4" x 240,000 BTU?s total input. Provide the following;

Water tubs to reduce flare-up.

Casters

Specification based on Magikitch?n model FM-RMB-672.

Provide commercial appliance connector hose kit. Kit includes: (2) swivel link connector fittings; 3/4" x 48" - 321 stainless steel, hydraulically formed flexible pipe with male nipple, S/S braided outer webbing, industrial cold welded fittings; Hansen manufacturing quick disconnect; 36" restraining cable with anchoring hardware; gas ball valve; (1) street EL. 10 year normal use warranty on structural integrity of hose against leaks, 5 year connector warranty.

Specification based on T & S series HG-4D-SK appliance hose kit.

Provide floor sink with steam deflector. Covering and extending back from the floor sink shown below the char broiler, provide a 20 ga. S/S steam diverter. (3) sided diverter with top and open back is approx. 8"W. to cover floor sink (field verify actual floor sink size), with 1" flanges turned outward 90? from sides, set in sealant and S/S screw anchored to floor to allow removal. Diverter with front to back upward sloped top shall extend approx. 6" past the back of the char broiler.

Item #101 - Griddle Top Heavy Duty Gas Range w/ Std. Oven Base:

One only provide heavy-duty gas griddle top gas range; 3/4" thick highly polished griddle top; stainless steel splashes; front grease trough w/ large capacity grease collector; (3)- 30,000 BTU burners w/ individual pilots & manual controls; 27.5"W. X 28.5"D. X 14.5"H. standard oven base with porcelain enamel on steel oven hearth, back and door liner; four (4) oven rack positions with one rack; 40,000 BTU oven burner w/ pilot ignition; counter balanced oven door; 1-1/4" front manifold; stainless steel front, bullnose and stub back; black epoxy powder coat sides; 3/4" x 130,000 BTU total input. Provide with the following;

Provide 26-1/2"H. single deck hi-shelf.

Provide 5" swivel casters, front (2) with brakes.

Provide 3/4" rear gas connection

Provide caps & covers on manifold ends.

Specification based on Wolf Commander model FS-0-27-FT36*M112

Provide commercial appliance connector hose kit. Kit includes: (2) swivel link connector fittings; 3/4" x 48" - 321 stainless steel, hydraulically formed flexible pipe with male nipple, S/S braided outer webbing, industrial cold welded fittings; Hansen manufacturing quick disconnect; 36" restraining cable with anchoring hardware; gas ball valve; (1) street EL. 10 year normal use warranty on structural integrity of hose against leaks, 5 year connector warranty.

Specification based on T & S series HG-4D-SK appliance hose kit.

Item #102 - Three Hot Top Heavy Duty Gas range W/ Std. Oven Base:

One only provide heavy-duty three hot top gas range; overall 36"W. x 38"D. X 36"H. to the cook top. (3) 35,000 BTU hot top burners w/ individual pilots, controls and heavy duty 12" x 27"D. top castings; 27.5"W. X 28.5"D. X 14.5"H. standard oven base with porcelain enamel on steel oven hearth, back and door liner; four (4) oven rack positions with one rack; 40,000 BTU oven burner w/ pilot ignition; counter balanced oven door; 1-1/4" front manifold; stainless

steel front, bullnose and stub back; black epoxy powder coat sides; 145,000 BTU total input.

Provide 26-1/2"H. single deck hi-shelf.

Provide 5" casters.

Provide 3/4" rear gas connection

Provide caps & covers on manifold ends.

Specification based on Wolf Commander model FS-0-27-3HT*M112

Provide commercial appliance connector hose kit Kit includes: (2) swivel link connector fittings; 3/4" x 48" - 321 stainless steel, hydraulically formed flexible pipe with male nipple, S/S braided outer webbing, industrial cold welded fittings; Hansen manufacturing quick disconnect; 36" restraining cable with anchoring hardware; gas ball valve; (1) street EL. 10 year normal use warranty on structural integrity of hose against leaks, 5 year connector warranty.

Specification based on T & S series HG-4D-SK*M112 Safe-T-Link appliance connector kit.

Item #103 - Six Burner Heavy Duty Gas Range W/ Std. Oven Base:

One only provide 36" wide heavy duty gas range w/ (6)- 30,000 BTU open burners and 40,000 BTU standard oven base, overall 36"w. X 38"D. X 36"H. to cook top. S/S front, bullnose and sub back; black epoxy powder coat painted sides; 1-1/4" dia. front gas manifold; (6) two piece open burners w/ individual pilots; 12"W. X 27"D. heavy duty cast iron top grates; controls in the cold zone; 27-1/2"W. x 28-1/2"D. x 14-1/2"H. oven w/ porcelain enamel oven hearth, back and door liner; One rack and Four rack positions; counter balanced oven door, 220,000 BTU total input. Provide the following options;

Provide 26-1/2"H. single deck hi-shelf.

Provide 5" casters.

Provide 3/4" rear gas connection.

Provide caps & covers on manifold ends

Specification based on Wolf model FS-6J-27.

Provide commercial appliance connector hose kit. Kit includes: (2) swivel link connector fittings; 3/4" x 48" - 321 stainless steel, hydraulically formed flexible pipe with male nipple, S/S braided outer webbing, industrial cold welded fittings; Hansen manufacturing quick disconnect; 48" restraining cable with anchoring hardware; gas ball valve; (1) street EL. 10 year normal use warranty on structural integrity of hose against leaks, 5 year connector warranty.

Specification based on T & S series HG-4D-SK appliance hose connector kit.

Item #104 - Electric Dbl. 65 lb. Tank Deep Fat Fryer W/ Under Filter, Basket Lifts, Casters:

One only provide Two (2) 65 lbs. deep fat fryers w/ single mesh basket, S/S tank, S/S exterior. Fryer, electric, heavy duty floor model, 65 - 80 lb. fat cap., digital solid state control, countdown timer, boil out, melt cycle, each overall 20-5/32"W. x 37-3/4"D. x 53"H. Swing away immersion type heating elements with hi temp.20% oil capacity deep cool zone; 18" x 18" fryer cooking area with minimum 4" depth; automatically shuts down at +450^{o}F.; fully programmable product keys; visual display and audible indication of temp., high oil temp., probe failure, cook time and product ready. Gray enamel cabinet with stainless steel front; full welded fry pot. Capacity for 120lbs of french fries per hour. Each wired for 208V, 3PH, 18 KW, 50A. Basket lifts 120V, 1PH 3.5 amps. Filtration system 115V, 1PH, 7 amps. Provide with the following options;

Provide Two (2) Basket Lifts in each pot.

Provide One (1) under fryer filtration system.

Provide Casters.

Specification based on Pitco model E18SS-D fryers with UFM filtration system.

Item #105 - Relocate Garland Dbl. Stack Gas Convection Oven:

One only relocate Garland Master Series double convection oven with single point connection hose and quick disconnect. Overall 38" x 38"D x 71"H. Each wired for 120V, 1PH, 8.5 amps. 120,000 BTU?s total input for both.

Item #106 - Relocate Blodgett Dbl. Stack Gas Convection Oven:

One only relocate Blodgett dbl. stack model DFG 100 -3. Single point gas connection with flex hose and quick disconnect. 115V., 1PH., 6 amps and 55,000 BTU?s per oven. Overall 38"W x 37"D x 71 1/4"H.

Item #107 - Dlb. Stack Gas Convection Oven:

One only provide double stack full size gas ovens, set on standard 6" legs. Furnish each section with five (5) standard racks. Each compartment to have; stainless steel front, sides, top and legs; black enamel back; slide out control module, simultaneously operating doors, (5) chrome plated wire racks, cool down or auto off interlock at door opening blower options, pilot spark ignition control system. Furnish with draft diverter for venting under a hood. Each oven compartment 55,000 B.T.U. Each wired for 120V, 1PH, 6 amps; (2) year parts and labor warranty; (5) year door warranty. Overall 38-1/8"W. x 36-7/8"D. x 76-5/8" to top of diverter. Provide the following options:

Gas connector to provide common connection point.

Casters.

Specification based on Blodgett DFG-100-DBL.

Provide commercial appliance connector hose kit. Kit includes: (2) swivel link connector fittings; 3/4" x 48" - 321 stainless steel, hydraulically formed flexible pipe with male nipple, S/S braided outer webbing, industrial cold welded fittings; Hansen manufacturing quick disconnect; 36" restraining cable with anchoring hardware; gas ball valve; (1) street EL. 10 year normal use warranty on structural integrity of hose against leaks, 5 year connector warranty.

Specification based on T & S series HG-4D-SK Safe-T-Link appliance hose kit.

Item #108 - Relocate Cleveland Dbl. Cavity (10) Pan Steamer:

One only relocate Cleveland 24CGA10 pressureless two compartment steamer, gas fired 125,000 BTU steam generator in 24"W. cabinet base; overall 24"W. X 35"D. X 65.5"H. Wired for 115V, 1PH.

Provide on the incoming water line to the generator, a water filtration system with deliming capabilities for steamers. 20 PSI min. pressure, 125 PSI max. pressure, 80^{o} F. max. temperature, to 1.5 GPM. Reduces limescale buildup, removes chlorine, controls alkalinity and pH. Meets NSF No. 42 for aesthetic effects by reducing chemicals(taste, odor and chlorine (class I)), particulate reduction (class II, 97% reduction of particles 1-5 microns or larger). Overall 19-3/4"W. x 31"L. x 6-1/2"D. with 19-3/4"W. mounting plate. Mount in an accessible location on the back wall.
Specification based on Everpure Kleensteam model AR-X.

Provide with Two (2) appliance connector water hoses, 3/8" x 72"L. coated hose with 3/8" NPT male thread one end, 1/2" Hansen manufacturing quick disconnect device one end.

Specification based on T & S series HW-4B-72
Provide commercial stationary gas appliance connector hose kit. Kit includes: ?" x 48" - 321 stainless steel, hydraulically formed flexible pipe with male nipple one end, S/S braided outer webbing, industrial cold welded fittings; Hansen manufacturing quick disconnect other end with brass swivel elbow fitting. 10 year normal use warranty on structural integrity of hose against leaks, 5 year connector warranty.
Specification based on T & S series HG-4C-48S Safe-T-Link commercial gas appliance connector kit.

Item #109a - 7'-0"' X 48" Capture Area Water Wash Ventilation Hood W/ Fire Suppression, Face Discharge M.U.A.:

One only provide wall type water wash exhaust hood with face discharge make-up air, 7'-0"L. x 2'-6"H., of one piece construction. Canopy hood capture area shall be overall 4'-0" inside dimension, front to back. Listed equivalent manufacturers and manufactures requesting approval as equals must operate satisfactorily with, exhaust CFM, Make-up air CFM and duct sizing as shown/schedules on drawings.

Ventilation hood shall be of the make-up air type. Shall be fabricated in accordance with N.F.P.A. bulletin 96, bear N.S.F. seal and bear U.L. Label for Commercial Cooking Hood use.

Construction: The hood(s) shall be constructed with 18 ga., type 304, stainless steel interior lining and with 18 ga. type 304. stainless steel exterior panels. Constructed using standing seam method. The assembly at joints and seams on the hood(s) shall be liquid tight. The exposed external welds shall be ground down, smooth and highly polished. Front and end panels stamped with vertical ribs to add strength and rigidity. Internal construction shall include galvanized structural steel framing members as required to prevent flexing and fatigue of the inner lines and outer shell. All unexposed interior surfaces shall be constructed of minimum 18 ga. galvanized steel including, but not limited to, duct, plenums, framing and brackets. Ventilators shall be installed with hanger rods to structural ceiling, and leveled, by this contractor at 6'-6" above finished floor to the bottom front edge. Provide 18 ga. stainless steel closure securely anchored to the hood extending to the finished ceiling at 10'-0". Provide 18 ga. stainless steel

fill panels at end and bottom to the adjacent hood. Duct collars sized as shown.

Grease Extractors: Grease is removed in full length, horizontal baffles which create high velocity centrifugal grease extraction. Non gasketed inspection doors provide full length access to each grease extraction plenum. Capable of documented 95% grease extraction per U.S. Navy specification NBSIR 74-505 test method. Hood extractors cleaned with a hot water, detergent spray introduced with a full length manifold which cleans entire length of the exhaust plenum. Extractor housing shall terminate in a pitched, full length collection trough with stainless steel drain fitting at the right end of the hood.

Water Wash Control Panel; Grease extractors automatically cleaned for 3 to 10 minutes upon fan shutdown. Water wash initiated by a programmable control panel of size capable for handling hoods 109a, 109b and 110. Control Panel constructed of 18 ga. S/S and includes; adjustable-flow detergent pump, wash cycle timer in solid state master programmable controller, 2-1/2 gallon detergent reservoir. Panel constructed with separate plumbing and electrical compartments. Faced mounted buttons control hood lights, fan start and fan stop / start wash. 120V., 1PH lighting circuit provided for control of lights in hoods 109a, 109b, 110. Normally closed switch, for interconnection to fire suppression system, will initiate a spray mist in exhaust ducts on activation of fire suppression system. Install control panel at location shown on drawings. Provide with the following options;

Reduced pressure back flow preventer & (2) isolation valves.

Internal piping for sequence washing of (3) separate hoods, solenoid control valves integral to water wash control cabinet. Control panel shall sequence washing of hoods 109a, 109b, & 110.

24 hour timer to control start time of wash cycles.

Low detergent indicator light.

115V., 1Amp fan control voltage line to be used to control fan packages for hoods 109a, 109b and 110.

Lighting: Vaporproof, U.L. Listed, marine light fixtures shall be installed at approximately 3'-0" centers. The lights shall be pre-wired to a junction box situated at the top of the hood for field connection to power. Junction box located as shown. The wiring shall conform to the requirements of the National Electrical Code. Light switch will be installed on the wall below the hood as shown by others.
Registers: The hood shall have the capacity to introduce make-up air to the front of the hood through a perforated face panel to reduce the quantity of tempered air being removed from kitchen. Perforated face shall minimize the velocity of make up air being introduced.

U.L. Listing: All components of hood shall be approved with the canopy as a complete assembly and conform to the U.L. Listing of the hood.

Ductwork and Fans: By Mechanical Contractor.

Furnish and install under this item, a Liquid Agent Automatic Fire Suppression System utilizing a nozzles to protect plenums, exhaust ducts, and equipment below hoods 109a, 109b, 110. Install remote stainless steel cabinet with cylinder/automan release and remote manual pull station at locations shown on drawings. Run piping unexposed where possible. All exposed piping shall be encased in stainless steel or chrome plated steel pipe shall be used. Exposed piping within ventilator not allowed, except over appliances. Provide micro-

switch with necessary qty. of contacts as required for electric items requiring fire/fuel shut-off(ref. elect. plans). Provide U.L. listed mechanical gas line shut-off valve adapted to the release mechanism cartridge receiver by means of a pneumatic piston type air cylinder. Valve size as shown on Mechanical Plans. Install system in strict accordance with recommendations of the manufacturer and conforming with N.F.P.A. standards 96 and 17A, latest edition of UL 300, and all local and/or State authorities having jurisdiction.

Specification is based on Greenheck model GWFW water wash hood with accessories specified and Ansul R-102 fire suppression system.

Item #109b - 16'-0"' X 48" Capture Area Water Wash Ventilation Hood W/ Fire Suppression, Face Discharge M.U.A:

One only provide wall type water wash exhaust hood with face discharge make-up air, 16'-0"L. x 2'-6"H., of one piece construction. Canopy hood capture area shall be overall 4'-0" inside dimension, front to back. Listed equivalent manufacturers and manufactures requesting approval as equals must operate satisfactorily with, exhaust CFM, Make-up air CFM and duct sizing as shown/schedules on drawings.

Ventilation hood shall be of the make-up air type. Shall be fabricated in accordance with N.F.P.A. bulletin 96, bear N.S.F. seal and bear U.L. Label for Commercial Cooking Hood use.

Construction: Same as Item 109a.

Grease Extractors: Same as Item 109a.

Water Wash Control Panel; Water wash control is provided through the control panels in Item 109a.

Lighting: Same as Item 109a and controlled at the water wash control panel of Item 109a.

Registers: Same as Item 109A.

U.L. Listing: Same as Item 109a.

Ductwork and Fans: By Mechanical Contractor.

Fire Suppression is provided from the system specified in Item 109a.

Item #110 - 12' X 48" Capture Area Water Wash Ventilation Hoods W/ Face Discharge M.U.A.:

One only provide wall type water wash exhaust hood with face discharge make-up air, 12'-0"L. x 2'-6"H., of one piece construction. Canopy hood capture area shall be overall 4'-0" inside dimension, front to back. Listed equivalent manufacturers and manufactures requesting approval as equals must operate satisfactorily with, exhaust CFM, Make-up air CFM and duct sizing as shown/schedules on drawings.

Ventilation hood shall be of the make-up air type. Shall be fabricated in accordance with N.F.P.A. bulletin 96, bear N.S.F. seal and bear U.L. Label for Commercial Cooking Hood use.

Construction: Same as Item 109a.

Grease Extractors: Same as Item 109a. Provide with left end trough drain.

Water Wash Control Panel; Water wash control is provided through the control panels in Item 109a.

Lighting: Same as Item 109a and controlled at the water wash control panel of Item 109a.

Registers: Same as Item 109A.

U.L. Listing: Same as Item 109a.

Ductwork and Fans: By Mechanical Contractor.

WARE WASHING

Item #200 - Relocate S/S (3) Compartment Sink:

One only relocate overall 12' 3 ?" x 27 ?"D x 34"H to the drain board top (3) compartment sink w/ bowl heater in left sink. Right end has 37" drainboard. (3) 24"W x 24"D x 13"H sink bowls. Left bowls has an a in tank heater controlled by a thermostat to the left of the left bowl. All (3) sinks have lever drains with over flows; back splash mounted 8" on center, ?" fitting, single lever fill faucet. Back splash extends 7" H above rolled rim with sloped top and 1" turn-up flush to wall at top. Badly soiled stainless steel legs. ?H? leg-sets at each end of drain boards. No crossrails between legs; (4) legs secured to bottom of sink bowls.

Replace legs.

Replace faucets with Two (2) - 3/4" Back Splash Faucets.

Replace drains with Three (3) Drain Plugs and Overflow Fittings.

Punch left drainboard and integrally weld in 18" disposal cone for Item No. 212.

Centered behind disposal, punch drain board top and provide Overhead Pre-Rinse Spray Fitting.

Punch backsplash for disposal vacuum breaker.

To the left of the disposal, below drainboard, fully weld in a disposal control bracket. Bracket mounted so face of control is recessed 1-1/2" from rolled rim edge.

Remove water heating element from left bowl and plug and continuously weld holes.

Item #201 - Dish Return Dish Rack Sorting Shelf:

Two only fabricate as shown, double sided dish rack sorting shelf continuously welded to and mounted on soiled dish table top. Constructed of 14 ga. corrosion resistant steel triangulated plates at ends and intermediate locations, allowing maximum quantity of dish racks on shelf. Supported on 1-5/8" legs at each end, no intermediate support legs. 1-5/8" horizontal tubes between plates and Two continuous span supporting 1-5/8" x 6" x 1-5/8" downward opening channels. All continuously welded. Overall approx. 10'-0"W. x 31"H. x 27"D.

Item #202 - Soiled Dish Table W/ 12"w. Scraping Trough, Pre-rinse Sink, Pre-rinse Spray:

One only provide ?L? shaped; as shown on drawings with unloading section approximately 2'-6" wide x 12'-0" long; and section to dishwasher, 2'-6" wide x 7'-5" long, all 34" high from work top to floor.

Construct with Dishtable Counter Edges at exposed ware washing area side. Lip into dishwasher in water tight manner. Standard backsplash at all walls. Seal at backsplash with clear G.E. silicone sealant.

At return window counter top shall extend through approx. 10'W. x 8"D. pass opening. Extend countertop 1" into Waiters Station area with 3/4" high inverted "V" edge, turn down 4" and return 90° for 1" back to the wall face with closed ends.

As detailed, provide 12"W. scrapping trough along ware washing side of dish table, turning the corner and mating with Troughveyor Disposal System. Provide 2" horizontal return from counter edge before turning down in to trough. Trough constructed of 14 ga. corrosion resistant material. Cove all vertical and horizontal corners on 1/2"R. Trough shall be 3" deep at origin end and approx. 6" deep at terminating end as required by Disposal System. Bottom shall slope downward at even decline. Punch origin end for water diffuser and Waiter's Station side of trough for Two gusher heads as shown. Taper trough in dish table top to mate with disposal system inlet.

Punch and fabricate dish table top to accept Troughveyor Waste Disposal System per manufacturers recommendations.

At the dish table corner turn, angle the front rolled rim of the dish table at 45° for 16" between the perpendicular legs of the dish table as shown.

Angle dish table back splash at 45° angle between perpendicular legs of dish table as shown. Provide 2'-10" clear width of table from rolled rim to face of angled back splash. Angled back splash shall have top return into corner to adjacent walls with a positive slope back onto dishtable. Wall edge of corner filler shall lip down 90° to fit into a wall secured "Z" clip. Front edge shall seal to sloped top of backsplash with no exposed fasteners.

As shown, at the corner turn in the dish table, provide in the dish table top a 20"W. x 8" front to back pre-rinse sink extending back from and emptying into the scrapping trough. Sink, approx. 4"D. with bottom sloped to empty into the scraping trough. Sink fully welded into dish table top.

Centered behind pre-rinse sink, provide Overhead Pre-Rinse Spray.

As detailed, at the pre-rinse sink, provide across top of sink and trough a removable 14 ga. corrosion resistant Angle Rack Guide, for easy sliding of 20" x 20" racks over sink / trough. Rack guide shall be constructed of 1-1/2" x 1-1/2" x 14 ga. stainless steel angles at the interior perimeter of the sink opening. Front and back angles with horizontal leg flush to table top and pointing into the sink; vertical leg extending up and providing a guide for racks to slide across the sink. Extend entry and exit ends of front and back angles vertical legs outward from the sink for 2" onto the dish table top to focus the racks onto the slide, the back angle extensions angled at 45°. Entry and exit end angles tack welded to the bottom of the front and back angles with the horizontal legs pointing into the sink and the vertical legs down and flush to the adjacent sink wall. Support front leg angle with stud 1/4"L. S/S studs welded to inside of trough.

Mount top on Open Base. Provide Open Base Removable Shelves, approx 10' below dish drop landing as shown.

Item #203 - Troughveyor Disposal System:

One only provide recirculated water trough feed disposal system , right to left water flow, overall 40-5/8"L. x 18-15/16"W. x 34"H. System includes; built-in water re-circulation system, pre-wired auto-reversing control panel, stainless steel NEMA 4X water tight enclosure, 304 stainless steel components, line voltage disconnects, solenoid valve, unions, check valves, incoming water valves, backflow prevention device. Wired for 208V, 3PH, 5.9hp, 19.8 amps. Provide the following options;

Trough Diffuser.

(2) - 3/4" gusher heads

Specification based on Salvajor 500-TVL*M112

Item #204 - 80" Extended Height Hot Water Sanitize Dish Machine W/ Pre-rinse:

One only provide, fully automatic, 44" single tank dish machine with rack conveyor, high temperature sanitizing, 36" pre-wash, right to left operation, 251 racks per hour; overall 79-1/2"L. Shall have 2 HP power wash motor, and optional 1 HP pre-wash motor all prewired to control panel; 1/6 HP gearmotor drives the conveyor at 7 FPM. 36"L pre-wash equipped with upper and lower stainless steel wash arms; 44" power wash section; 10" 6.3 gpm final rinse. Provide with positive low water protection with float and reed switch. Top mounted S/S controls and dial thermometers, S/S front panel - frame - feet - legs, door actuated drain closer and door interlocks, automatic fill, removable self-flushing S/S pans and large deep S/S baskets, common electrical - common water - common drain connections. Furnish with all standard equipment in accordance with manufacturers standard specifications. Wired for 208V, 3PH, 62.4 amps. Provide the following options:

15 KW electric wash tank heating.

Two (2) Stainless steel extended vent hoods with vent stack and locking damper.

6" higher that standard pre-wash, washing and rinsing compartments.

Single point electrical connection.

Provide with contactor/switch for control of vent fan.

(4) - 250-TX racks for 18 x 26 pans

Specification based on Hobart CPW-80A.
Furnish and install with dishwasher, from extended vents, One (1) at each end 20 ga. 4" x 16" stainless steel duct and extend to 3" above finish ceiling at approx. 10'-0", with 1" stainless steel perimeter trim at ceiling.

Fabricate, as detailed, Three 16ga. S/S, 10"W. Dish Machine Splash Guards extending down from the extended vent hoods at entry end front and exit end front and back. Bolted to the 45^{o} bottom face of the extended vent hoods, the closure panels shall turn downward at the inside edge of the hood, extending to 1" above the dish table top. Seal closures to rolled rims and face edge of dish machine.

Item #205 - Booster Heater:

One only provide electric booster heater providing a rise from 140° to 180° for Dish Machine Item No. 204. S/S exterior front; sides, back and bottom of gray enamel finish. Tank shall be 10 year warrantied Castone. Front accessible controls; pre-plumbed, wired and calibrated. Furnish with temperature/pressure relief valve, pressure reducing valve, two temperature/pressure gauges, high temperature limit control and low water cut-off, on-off switch with pilot light. 23-1/2"W. x 23"D. x 31-3/8"H. Wired for 208V, 3PH, 36 KW, 100A. Provide the following options;

Stainless steel legs.

Stainless steel exterior.

Specification based on Hatco Imperial S-36.

Item #206 - Under Counter Spray Hose Reel:

One only provide 35' hose reel on bottom of clean dish table. Exposed reel hose with spray valve, and mounting base; installed as detailed, support arm rotated with hose off top of reel and spray head supported off the floor. Fully weld reel rinse bracket to underside of table.

Provide 12 ga. S/S fixture support bracket, 8"W. x 6"H. Provide with 60° top to bottom tapered sides turned back 90° from the face. Top of side to have 1" 90° inward return which welds to table bottom. Radius bottom corners 1/2". Provide 3" centers remote dual control valve with internal check valves. Back flow prevention devices required by PC as shown.

Specification based on T & S B-1435 stainless steel hose reel and T & S B-0512 concealed mixing faucet.

Item #207 - Clean Dish Table:

One only provide as shown on drawing, overall 12'L. x 30"W. x 34"H. from work top to floor. Slope dish table top for positive drainage.

Construct top with Dish Table Counter Edges. Lip top into dishwasher in watertight manner. Shall have standard Backsplashes at all walls.

Mount top on standard Open Base. No front cross rails at booster heater. Provide Open Base Removable Shelves, approx. 8'-0"L. from left end, as shown.

Item #208 - Clean Dish Wall Mount Dish Rack Sorting Shelf (2 Only):

Two only provide dbl. rack capacity, knock down, (4) bar wall mounted sorting shelf, overall 62"L. x 18"D. x 11-1/4"H. Supports cup & glass racks flat or slanted position. 14 ga. 300 series S/S end brackets with 1-5/8" 18 ga. S/S tubing, finished #3.

Specification based on Advance Tabco DT-6R-23.

Item #209 - 72"H. Mobile Pot & Pan Racks (2 Only):

Two only provide mobile storage shelving. Horizontal shelf frames and posts constructed of abrasion resistant epoxy finish on electroplated steel. Removable injection molded polypropylene mats set atop horizontal frames. Reinforced nylon wedges fit 1" incremented post grooves to secure shelf frames

in position. Quick release locks in corners allow easy shelf adjustment. Units comprised of;

Four (4) open grid mat shelves, 24"W. x 48"L. with frame and wedge lock connectors.

Four (4) posts, 75-1/2"H.

Four (4) stem swivel casters, (2) with brakes.

Specification based on Intermetro MetroMax Q storage system with Q2448G shelves, Q74UPE posts.

Item #210 - Mobile Silver Soak Sinks (2 Only):

Two only provide portable sink, 34" high on legs with casters; overall 23-1/2" x 23-1/2" x 34"H. 20" x 20" x 14" D sink compartment sink, 16 ga. 304 s/s construction, 1-3/4" rolled rim all sides, s/s legs, (4) swivel caster (2) w/brakes. Provide with special height legs for 34"H., lever drain and drain tailpiece to 2" above the floor

Specification based on modified Duke Manufacturing model SKS20.

Item #211 - 12'-0" Four Bar Wall Pot & Pan Drying Shelf:

One only provide 13"D., (4) - bar pot shelf constructed of 1" O.D. 18 gauge stainless steel tubing horizontally run parallel to the supporting wall. Front tube flush to front edge of supporting brackets with remaining tubes spaced from the front edge at 3-1/2" O.C., with 1-1/2" space from back tube to wall. Tubing, continuously welded between end and mid-span (as required) tapered cantilevered wall brackets, perpendicular to the wall. Wall brackets constructed of 14 ga. stainless steel. Brackets at 4'-0" O.C. maximum. Aligned with the bottom of the tubes, provide a continuous 6"H. X 18 ga. stainless steel wall protection panel behind the shelf.

Upward supporting brackets are 14"H. overall, extending from 1/2" below the tubes with front lower corner radiused 1". Provide bracket with a vertical front edge extending 2" above top of tubes, then tapering back to the wall. Wall edges of bracket turn 90^{o} inward, flush to the wall for 1-1/2" and are expansion anchored thereto.

Item #212 - (3) Compartment Sink Disposal:

One only provide a water cooled disposal, with 6 1/2" throat opening; and 18" dia. cone; 1/2" vacuum breaker, flow control, and 1/2" solenoid. Provide disposer with magnetic On-Off control and control mounting bracket. Disposer shall be 2 H.P. Cone integrally welded in left drain board of Item 200 and mounting bracket stud bolted below. Wired for 208V, 1PH, 12.1 amps

Specification based on Salvajor Model 200-CA-MSS3-18 cone adapter disposer assembly.

Provide water inlet in cone; water inlet fitting aimed to wash perimeter of cone in a cyclonic action.

Specification based on Fisher Mfg. Co. model no. 2906.

Item #213 - 36"H. Mobile Pot & Pan Shelves (2 Only):

Two only provide units constructed same as Item 209. Each unit comprised of;

Four (4) open grid mat shelves,24"W. x 48"L. with frame and wedge lock connectors.

Four (4) posts, 33"H.

Four (4) stem swivel casters, (2) with brakes.

Specification based on Intermetro MetroMax Q storage system with Q2448G shelves, Q33UPE posts.

PREPARATION EQUIPMENT

Item #300 - 48" X 96" Cutting Board Work Table:

One only provide overall 48"W. x 96" long x approx. 36" high to work top (match height of adjacent table Item No. 302).

Construct top of 1" thick "Richlite"*M112, phenolic wood fiber laminate. Underbrace with 1" x 4", 14 ga. stainless steel channel, securely anchored to top underside. Provide 1-1/2" wide, 18 ga. stainless steel apron attached to all sides of top underside, except where interrupted by cabinet base. Apron shall be channel shaped, having edges turned inward ?".

Provide two (2) tiers of three (3) Drawers, in Closed Base. Drawers located as shown. Remainder of base shall be standard Open Base with Open Base Stationary Shelf full length.

Provide centered in length, elevated shelf and 3-bar overhead utensil rack. Support elevated shelf and rack between 7'-6"H., S/S, 1-5/8" O.D. - 16GA. tubing supports extending down through the top to the floor with adjustable feet; welded to and supporting Open Base Shelf; welded to interior of Drawer Closed Base. At 18" above the work top, provide centered on tubing supports, an 18"W. x 8'-0"L. x 16 ga. stainless steel elevated shelf with ?"H. inverted "V" edge all sides, turn down 1-1/2" with 1/2" x 30? toe-in at bottom edge. Shelf stud bolted to 14 ga. S/S knife edge supports fully welded to support tubing. Provide 1" x 4" x 1" hat channel centered under shelf to allow unsupported span between supports. Fixed ht. utensil / pot & pan rack comprised of a rectangular bar upper rack with lower single bar. Bars are 2" x 1/4" stainless steel. Upper horizontal bar approx. 22"W. x 8'-0"L. with 4" radiused corners, bar fully welded to tubing supports. Lower single horizontal bar, at 12" below upper rectangular bar, diagonally braced (on each side) back to upper bars at 60" O.C. max. and fully welded to tubing supports. Provide One (1) pan hook for each 1'0" of bar length (24).

Provide Four (4) under counter electrical receptacle boxes, two at each end as shown. Wired for 120V, 1PH, 20 amps.

At open end of table, enclose/box-in a 4" x 4" x 1"H. section of the table top/leg under brace open channel with 16 ga. S/S. Bolt to the enclosure and faced outward, a fabricated 16ga. stainless steel or Component Hardware Group Inc. model no. R58-1010 single faced cast aluminum tombstone electrical outlet box with brushed satin finish and ground screw. Drill the back of the tombstone/box for a 1/2" I.P.S. adapter.

At drawer end, provide galvanized steel receptacle box mounted to in side of Closed Base.

Receptacle device, connection and cover plate by other trades.

Item #301 - Relocate Mobile 30" x 48" S/S Flat Top Work Table W/ Under Shelf:

One only relocate 30" x 48"L. flat top work table with bullnose edge all sides; all stainless steel construction with bolted on stainless steel undershelf; badly soiled 5" casters. Provide with Four (4) new 5" stem swivel / brake casters.

Item #302 - Relocate 30" x 72" S/S Flat Top Work Table W/ Under Shelf (2 Only):

Two only relocate 30" x 72"L. flat top work table with bullnose edge all sides; all stainless steel construction; welded stainless steel base; bullet feet. Of (4) such tables on site, select the best two in construction.

Item #303 - Not Used

Item #304 - Not Used

Item #305 - Relocate S/S (3) Compartment Sink W/ Disposal:

One only relocate stainless steel (3) compartment sink, overall 12' 3 ?" x 27 ?"D x 34"H to the drain board top . Right end has 37" drainboard; (3) 24"W x 24"D x 13"H sink bowls. All (3) sinks have lever drains with over flows; two back splash mounted 8" on center ?" single lever control fill faucets. Back splash extends 7" H above rolled rim with sloped top and 1" turn-up flush to wall at top. Badly soiled stainless steel legs. ?H? leg-sets at each end of drain boards. No crossrails between legs; (4) legs secured to bottom of sink bowls. Disposal in right sink bowl with disposal control panel mounted below right drainboard.

Remove disposal from right sink.

Remove disposal control from right drain board

Repair right sink for 3-1/2" lever drain installation. Punch back of sink bowl for overflow installation.

Replace legs.

Replace faucets with Two (2) - 1/2" Back Splash Faucets.

Replace drains with Three (3) Drain Plugs and Overflow Fittings.

Punch right drainboard and integrally weld in 18" disposal cone for Item No. 306

Centered behind disposal, punch drain board top and provide Overhead Pre-Rinse Spray Fitting.

Punch backsplash for disposal vacuum breaker.

To the left of the disposal, below drainboard, fully weld in a disposal control mounting bracket. Bracket mounted so face of control is recessed 1-1/2" from rolled rim edge.

Item #306 - (3) compartment Sink Disposal:

One only provide a water cooled disposal, with 6 1/2" throat opening; and 18" dia. cone; 1/2" vacuum breaker, flow control, and 1/2" solenoid. Provide

disposer with magnetic On-Off control and mounting bracket. Disposer shall be 1.5 H.P. Cone integrally welded in right drain board of Item 305 with mounting bracket stub bolted below. Wired for 208V, 1PH, 12.1 amps.

Specification based on Salvajor Model 150-CA-MSS3-18 cone adapter disposer assembly.

Provide water inlet in cone; water inlet fitting aimed to wash perimeter of cone in a cyclonic action.

Specification based on Fisher Mfg. Co. model no. 2906.

Item #307 - Proofer / Hot Holding Cabinets (2 Only):

Two only provide mobile, proofer / hot holding cabinet; all 304 stainless steel construction; insulated throughout; single section; individually controlled variable humidity / temperature heat system; fan forced moist air circulation; controls mounted at eye level; 12 pair of removable universal rod type pan slides at 4.5"on center; push handle; full perimeter bumper; 5" poly casters. Capable of 190?F. hot holding temperature 95% humidity at 95?F. Wired for 120V, 1PH, 13.75 amps.

Specification based on FWE model PH-1826-18/BH

Item #308 - Automatic Slicer and Stand (2 Only):

Two only provide heavy duty automatic slicer; variable 1 to 60 strokes per minute; 12" dia. knife; top mounted knife sharpener; stainless steel base, food chute, slicer table, end weight, motor cover and knife cover; precision slice thickness control; gear-driven blade assembly; auto shut off; lift lever; 1/2 Hp knife, 115/60/1, 7 amps.

Specification based on Globe model 4875V

Provide slicer stand, overall 26-1/4" L X 30" D X 30"H. open base with 3 pair channel slides below for 18" X 26" pans; all stainless steel construction; 18 ga. top reinforce with 12 ga. steel plate; 5" HD swivel casters (2 with brakes) in 1-1/4" square legs.

Specification based on Caddy model T-243-A.

Item #309 - Large Cavity Microwave & Stand:

One only provide, 2100 watts, with Four magnetrons having top and bottom energy feed; 1.6 cu ft. cavity capacity accommodates (2) 4" deep full size pans; 8 programmable memory pads; Five power levels; self diagnostic; S/S cabinet and cavity; digital display; removable center shelf; drop down type door; oven light; cord with NEMA 6-30P. Overall 21-1/16"Wx13"Dx9-7/8"H, 208-/230V/60/1, 30A circuit, UL, NSF

Specification based on Panasonic model NE-2180.

Provide a mobile table, overall 30"W. x 30"L. x 36"H. to work top. Construct with typical Countertop and Work Table Counter Edges all sides. Set atop Open Base. Provide with Open Base Stationary Shelf below. Set atop standard casters, (2) fixed, (2) swivel, (2) with brakes.

Item #310 - Relocate 20 qt. Mixer & Stand:

One only relocate Hobart A200, 115V 1/3 hp 8.2 amps; setting atop painted base mobile mixer stand; overall 23" W x 29"D x 29"H with stainless steel top with inverted ?V? edge; single pole attachment rack.

Refinish the stand base. Thoroughly clean of all grease and kitchen generated contaminants; thoroughly sand removing all loose paint and etching existing paint for thorough adhesion of new paint; clean of all residue. Prime and repaint with fast drying, lead free Hammartone Gray enamel. Paint shall dry to a permanent (non-residual), hard, washable, rust preventing finish. Paint shall be consistently applied with complete coverage and without drips, runs, orange peel. Wired for 115V, 1PH, 8.2 amps.

Specification based on Component Hardware model no. M92-1014

Provide with new 4"H. swivel stem casters, front 2 with brakes.

Item #311 - 36"H. Bulk Hot Food Transport Cabinets (2 Only):

Two only provide mobile heated half-size cabinet; overall 28-1/16"W. X 31-1/8"D. X 36-11/16"H. on 5" diameter casters. Electro-mechanical thermostat; thermometer; 900W heating system maintains 200^{o}F. 22 ga. stainless steel body; body reinforced with internal channels; fully insulated with 1" & 1-1/2" fiberglass; field reversible door with spring compression transport latch and perimeter neoprene gasket; extruded angle pan supports for 18" x 26" sheet pans and 12" x 20" steam table pans; Two bale handles on each side. Wired for 120V, 1PH, 7.5 amps. Provide the following options;

Corner bumpers.

Specification based on Cres-Cor model H-339-SS-UA-8C.

Item #312 - Not Used

Item #313 - 10'-0" WALL SHELF:

One only provide and mount on wall, wall shelves, overall 120"L. x 10"W., Mounted at 18" above drain board top. 16 ga. S/S wall brackets are shipped loose, 16 ga. 304 S/S shelf with 2" turn-up at wall, 1-1/2" turn down at 90? with 1/2" toe-in at 45? on exposed sides.; all corners TIG welded, ground and polished.

Specification based on Universal Stainless model WSD-12010

WALK-INS & STORAGE

Item #400/401 - 7-6"' x 15'-6" Walk-in Meat Refrigerator & 7'-6" x 15'-6" Walk-in Dairy / Veg. Refrigerator W/ Glass Reach in Doors:

One only furnish all labor, materials, and equipment for complete installation of sectional walk-in refrigerator/freezer unit as shown on drawings and specified herein. Shall include lights, thermometers, time clock, expansion valves, solenoid valves, temperature control, sight glass, drier , head pressure control, crankcase heater, anti-sweat heater, cables, pilot lights, evaporators, outside condensing units, accessories and all other required parts and refrigeration specialties for complete first class installation.

Refrigerants shall be in compliance with the Montreal Protocol for reduced CFC content; refrigerator using R-22 refrigerant. Install compressors, refrigerant piping and refrigerant as specified, hereinafter. Walk-in box N.S.F. approved.

Design layout and overall size of walk-in units as shown on plans and as specified. Shall be overall size 15'-6"W. x 15'-0"D. x 8'-7" high from exterior top to bottom of pre-fab floor. Walk-in shall consist of two (2) storage compartments being separated by common insulated wall. Each compartment of equal size.. Each compartment being completely free of other for use and operation. Unit shall be installed atop an existing supported slab with basement below.

Provide walk-in with 4" insulated floor designed to with stand uniformly distributed loads of minimum 600 lbs per square foot. Floor underside 26 gauge smooth galvanized steel. NSF interior floor of 0.100 smooth aluminum. Provide door sill at door. Provide floor panels in maximum lengths and widths to minimize joints and avoid mid floor panel corners.

Field installed over the top of floor panels, provide a floor wear surface of .188" 6061-T6 mill finish aluminum tread plate meeting ASTM B642. Joints in tread plate shall be staggered, offset from insulated floor panel joints by minimum 18". Secure tread plate to insulated panels per manufacturers recommendations. Tread plate / floor panel construction shall support minimum 400 lb point loading from casters.

Provide interior ramp at entrance door from ambient space. Ramp width same as door, depth 19 ?" from inside of door threshold with incline angle of 11 ? degrees. Construction shall include a foamed-in-place, 22 gauge type 304 stainless steel with heavy underlay to support top wear surface. Non-skid strips for safety. Reinforce ramp for heavy rolling traffic.

Construct all exterior and interior surfaces of 0.040 embossed aluminum. Insulate walk-in throughout, with 4" foamed-in-place, rigid U.L. fire rated, 100% foamed-in-place polyurethane insulation 4" thick, UL Class 1, bonded by an adhesive to the interior and the exterior metal pan skins and heat cured. Panel sizes are in 6" increments, with a minimum width of 6" and a maximum width of 48"; cam lock type fasteners are used as joining devices: each skin formed using 90? bend on each edge; All panels are U.L. label. Panels joints are interlocking male and female tongue and groove shapes; panel edge shall have a gaskets which provide a positive seal that meets NSF standards; flame spread rating according to ASTM E-84/UL 723 shall be less than 25 and a smoke rating not exceeding 450. "R" factor of 33. Food service contractor shall provide penetrations thru insulated cabinet exterior & is responsible for sealing them.

On exposed-to-view exterior of walk-in box panels and doors, and on interior side of doors, provide 1/8" x 36"H. aluminum tread plate wainscot mechanically secured and sealed thereto.

Doors shall be in-fitting, flush design w/ minimum 36" opening width by 78"H. in a 48" panel. Door section shall provide a full 4 inches of polyurethane, HFC-134a insulation construction and finish shall be same as the adjoining wall panels. Bottom of door shall seal with an adjustable double sweep gasket, to provide complete seal between door threshold and door jamb. Door jamb shall be a fully coved, extruded welded, structural anodized aluminum. Threshold plate shall be constructed of extruded aluminum for bearing weight.

Door hardware shall be high pressure die-cast zinc with a polished chrome finish.

Provide 4" dial thermometer with accurate temperature sensing from -40? to +60?F.; with both Fahrenheit and Centigrade scales; 5' capillary sensing tube; calibration adjustment screw.

Dead Bolt Lock required on all doors. Outside the dead bolt lock shall be operated by a key and shall have an inside safety release. Provide (5) keys.

At door to ambient space, provide Vinyl Strip Curtains. Vinyl strips shall be 6" wide with minimum thickness of 0.070 inches and minimum overlap of 2".

Lighting: Provide incandescent vaporproof gasketed UL listed light fixtures, made of cast aluminum with a Lexan globe. Light includes constant burning night light. Standard light mounts at interior strike side of door panels section. Light switch w/ pilot light adjacent to door on exterior is pre-wired to interior door section mounted light with concealed wiring in conduit within insulated panel. All light fixtures shall operate on 115 VAC.

Provide Two additional light fixtures for field installation as shown on plans.

Provide 75 watt bulbs for all fixtures.

Structurally design ceiling sections to span area shown, without dip or bulge, in horizontal planes and provide exterior ceiling suspension beams where required.

Ceiling panels: 4? thick with one piece foamed-in-place edge caps. Metal face skins are to incorporate seams using a double 90? bend at maximum width of two feet for additional strength. The joint between the ceiling and wall shall form a 45? angle. Ceiling topside 26 gauge smooth galvanized steel,

Provide vertical flat strips of same material and gauge as walk-in exterior wall surface, where walk-in is adjacent to walls and/or columns. Crimp all angle trim strip edges down slightly, to hug adjacent surfaces. Attach trim strips with 1/8" aluminum pop rivets, using only minimum required number to give neat installation.

Provide closure panels of same material and gauge as walk-in exterior wall surface, at exposed edges of walk-in top, as shown on the drawings, to finish ceiling. Panels fit snugly in top and bottom channels providing a straight and uniform appearance without gaps, tin-panning and irregularities.

Provide pre-fitted remote refrigeration system for remote installation set on exterior concrete slab as located on drawings, including all standard parts, refrigeration specialties, factory sized refrigeration lines, air cooled condensing units, with weather-proof covers and low ambient kit/winter

controls using head pressure control valves and other items necessary for a complete and properly operating system. Hang evaporators with nylon bolts. Set units on racks at least 4" above slab. Provide (5) year compressor warranty.

Provide Item 400 - Meat Refrigerator with 6528 BTU/Hr. capacity pre-fitted remote semi-hermetic refrigeration system with 1 horsepower condensing unit and matched evaporator coil for refrigerator to operate at 35^{o} F. Condensor wired for 208V, 3PH, 15A circuit. Evaporator wired for 115V, 1PH, 15A circuit.

Provide Item 401 - Dairy / Veg. Refrigerator 9665 BTU/Hr. capacity pre-fitted remote semi-hermetic refrigeration system with 1.5 horsepower condensing unit and matched evaporator coil for refrigerator to operate at 35^{o} F. Condensor

wired for 208V, 3PH, 15A circuit. Evaporator wired for 115V, 1PH, 15A circuit.

Weather proof covers shall provide hail protection to evaporator coils.

Condensing units shall be set on exterior concrete slab in location directed and shown on drawings All refrigerant lines shall be sized for distances shown, for proper operation.

Extend evaporator condensate drains to floor sink as shown. Extend drain lines with cooper tubing having minimum diameter of 5/8" radius per manufacturers recommendations. Run lines as shown with minimum slope of 1/4" per foot.

Provide Two (2) glass reach-in doors to ambient space, where shown. Normal temperature swing doors, nominal 26"W. x 63"N., unheated two pane tempered safety glass, door and frame without shelves and lighting. Actual door sizes 25-15/16" x 63-1/16". Aluminum extrusion door with reversible swing hinge, self-closing, 90^{o} door stop and hold open, full perimeter gasket. Heliarc-welded frame assembly, thermal gard frame insulation, pre-wired heaters, interconnect to junction box at top of door. Doors guaranteed 10 years against condensation between glass lites. Standard handle, outside door guards on each door. Provide with key locking means for security. 120V., 1.1A door heaters.
Reach-in door specification based on Ardco Inc. Cooler reach-in doors, Normal Temperature Swing Door, Swingline 3,

It is the intention of this specification for a complete refrigeration system, including all refrigeration specialties and all other parts, devices and accessories required for a complete and properly functioning system, furnished and installed whether or not each item is specifically mentioned in the specifications.

Walk-in box specification based on Nor-lake Fineline Custom Walk-ins

Item #402 - 8'-6" X 19' Walk-In Freezer:

One only furnish all labor, materials, and equipment for complete installation of sectional walk-in freezer unit as shown on drawings and specified herein. Shall include lights, thermometers, time clock, expansion valves, solenoid valves, temperature control, sight glass, drier , head pressure control, crankcase heater, anti-sweat heater, cables, pilot lights, evaporators, outside condensing units, accessories and all other required parts and refrigeration specialties for complete first class installation. Refrigerants shall be in compliance with the Montreal Protocol for reduced CFC content; freezer using R-404A refrigerant. Install compressors, refrigerant piping and refrigerant as specified, hereinafter. See refrigeration requirements paragraph of these specifications.

Walk-in box N.S.F. approved.

Design layout and overall size of walk-in units as shown on plans and as specified. Shall be overall size approximately 8'-6" wide x 19'-0" long x 8'-7" high from exterior top to bottom of pre-fab floor. Unit shall be installed atop a supported concrete slab with basement below.

Provide walk-in with 4" insulated floor designed to with stand uniformly distributed loads of minimum 600 lbs per square foot. Floor underside 26 gauge smooth galvanized steel. NSF interior floor of 0.100 smooth aluminum. Insulated floor will set on a 4-1/2" recessed slab; walk-in floor flush to

finished floor of kitchen. Coordinate walk-in installation with General Contractor. This Contractor shall install door sills. At door, a tapered interior sill plate shall be provided to reduce the tripping hazard caused by the NSF coved floor. Provide floor panels in maximum lengths and widths to minimize joints and avoid mid floor panel corners.

Install over the top of insulated floor, a floor wear surface of .188" 6061-T6 mill finish aluminum tread plate meeting ASTM B642. Joints in tread plate shall be staggered, offset from insulated floor panel joints by minimum 18". Secure tread plate to insulated panels per manufacturers recommendations. Tread plate / floor panel construction shall support minimum 400 lb point loading from casters.

Provide Interior Ramp at entrance door. Ramp width shall match the interior of door, depth 19 ?" from inside of door threshold with incline angle of 11 ? degrees. Construction shall include a foamed-in-place, 22 gauge type 304 stainless steel with heavy underlay to support top wear surface. Non-skid strips for safety. Reinforce ramp for heavy rolling traffic.

Construct all exterior and interior surfaces of 0.040 embossed aluminum. Insulate walk-in throughout, with 4" foamed-in-place, rigid U.L. fire rated, 100% foamed-in-place polyurethane insulation 4" thick, UL Class 1, bonded by an adhesive to the interior and the exterior metal pan skins and heat cured. Panels fabricated in 6" increments, with a minimum width of 6" and a maximum width of 48"; cam lock type fasteners are used as joining devices: each skin formed using 90? bend on each edge; All panels are U.L. label. Panels joints are interlocking male and female tongue and groove shapes; panel edge shall have a gaskets which provide a positive seal that meets NSF standards; flame spread rating according to ASTM E-84/UL 723 shall be less than 25 and a smoke rating not exceeding 450. "R" factor of 33. Food service contractor shall provide penetrations thru insulated cabinet exterior & is responsible for sealing them.

On exposed-to-view exterior of walk-in box panels and doors, and on interior side of doors, provide 1/8" x 36"H. aluminum tread plate wainscot mechanically secured and sealed thereto.

Provide heated pressure relief port in freezer door section. Factory-wire relief port to J-box at door section.

Door shall be in-fitting, flush design w/ minimum 36" opening width by 78"H. in a 48" panel. Door section shall provide a full 4 inches of polyurethane, HFC-134a insulation construction and finish shall be same as the adjoining wall panels. Bottom of door shall seal with an adjustable double sweep gasket, to provide complete seal between door threshold and door jamb. Door jamb shall be a fully coved, extruded welded, structural anodized aluminum. Threshold plate shall be constructed of extruded aluminum for bearing weight. Doors shall have an anti-sweat heater wire around entire perimeter of door opening and under threshold; door swing as indicated on drawings.

Door hardware shall be high pressure die-cast zinc with a polished chrome finish.

Provide 4" dial thermometer with accurate temperature sensing from -40? to +60?F.; with both Fahrenheit and Centigrade scales; 5' capillary sensing tube; calibration adjustment screw.

Dead Bolt Lock required on all doors. Outside the dead bolt lock shall be operated by a key and shall have an inside safety release. Provide (5) keys.

Provide Vinyl Strip Curtain and entry door. Vinyl strips shall be 6" wide with minimum thickness of 0.070 inches and minimum overlap of 2".

Lighting: Provide incandescent vaporproof gasketed UL listed light fixtures, made of cast aluminum with a Lexan globe. Light includes constant burning night light. Light mounts at interior strike side of door panels section. Light switch w/ pilot light adjacent to door on exterior is pre-wired to interior door section mounted light with concealed wiring in conduit within insulated panel. All light fixtures shall operate on 115 VAC.

Provide Two (2) additional light fixtures for field installation as shown on plans.

Provide 75 watt bulbs for all fixtures.

Structurally design ceiling sections to span area shown, without dip or bulge, in horizontal planes and provide exterior ceiling suspension beams where required.

Ceiling panels: 4? thick with one piece foamed-in-place edge caps. Metal face skins are to incorporate seams using a double 90? bend at maximum width of two feet for additional strength. The joint between the ceiling and wall shall form a 45? angle. Ceiling topside 26 gauge smooth galvanized steel,

Provide vertical flat strips of same material and gauge as walk-in exterior wall surface, where walk-in is adjacent to walls and/or columns. Crimp all angle trim strip edges down slightly, to hug adjacent surfaces. Attach trim strips with 1/8" aluminum pop rivets, using only minimum required number to give neat installation.

Provide closure panels of same material and gauge as walk-in exterior wall surface, at exposed edges of walk-in top, as shown on the drawings, to finish ceiling at 10'-0". Panels fit snugly in top and bottom channels providing a straight and uniform appearance without gaps, tin-panning and irregularities.

Provide pre-fitted remote refrigeration system for remote installation set on exterior concrete slab as located on drawings, including all standard parts, refrigeration specialties, factory sized refrigeration lines, electric defrost for freezer, air cooled condensing unit, with weather-proof covers and low ambient kit/winter controls using head pressure control valves and other items necessary for a complete and properly operating system. Hang evaporators with nylon bolts. Set units on racks at least 4" above slab. Provide (5) year compressor warranty.

Provide freezer with 7935 BTU/Hr. capacity pre-fitted remote semi-hermetic refrigeration system with 2 horsepower condensing unit and matched evaporator coil with electric defrost for freezer to operate at -10^{o}F. Condensor wired for 208V, 3PH, 20A circuit. Evaporator wired for 208V, 1PH, 15A pulled from condensor.

Weather proof cover shall provide hail protection for evaporator coils.

Condensing units shall be set on exterior concrete slab in location directed and shown on drawings. All refrigerant lines shall be sized for distances shown, for proper operation.

Extend evaporator condensate drains to floor sink as shown. Extend drain lines with cooper tubing having minimum diameter of 5/8" radius per manufacturers recommendations. Run lines as shown with minimum slope of 1/4" per foot. Condensate line wrapped with electric heater wires and insulation

to prevent freezing of condensate. Heat tape and insulation by Food Service Contractor. Connect heater wires to power supply at evaporator.

It is the intention of this specification for a complete refrigeration system, including all refrigeration specialties and all other parts, devices and accessories required for a complete and properly functioning system, furnished and installed whether or not each item is specifically mentioned in the specifications.

Walk-in box specification based on Nor-lake Fineline Custom Walk-ins

Item #403 - Walk-In Shelving (1 Lot Only):

One lot only furnish, assemble and set in place, the following stationary storage system shelving. Shelves and posts constructed of electroplated carbon steel, and coated with a epoxy coating. Coating shall have a a 10 year limited warranty against rust formation. Welded wire shelves constructed with front to back running 9 GA. wire on 1.3 to 1.6 inch centers, supported beneath by 6 GA. side to side wire on 8" centers and perimeter truss constructed with 2 GA. top and bottom wire with intermediate 7 GA. truss wire. Truss wires welded to tapered collars at the corners. Plastic split sleeves fit within shelf collars and wedge into 1" incremented grooves on posts. Each unit constructed with 74 5/8" high posts, (4) shelves high, with all standard parts and accessories necessary for a complete installation. Provide ?S? clips at interior corners avoiding interior corner posts. Provide shelving comprised of the following;

One (1)unit 18"W. x 30"L.

Eight (8) units 18"W x 36"L

One (1) unit 18"W x 42"L

Eight (8) units 18" x 48"

One (1) unit 24"W x 30"L

Two (2) units 24"W x 36"L

Five (5) units 24"W x 42"L

One (1)unit 24"W x 48'L

One (1) unit 24"W x 54"L

Specification based on Intermetro Industries Corp. model Super Erecta wire shelving with Metroseal II finish.

Item #404 - DRY STORAGE SHELVING (1 Lot Only):

One lot only furnish, assemble and set in place, the following stationary storage system shelving. Shelves and posts constructed of electroplated carbon steel and dipped bright zinc. Welded wire shelves constructed with front to back running 9 GA. wire on 1.3 to 1.6 inch centers, supported beneath by 6 GA. side to side wire on 8" centers and perimeter truss constructed with 2 GA. top and bottom wire with intermediate 7 GA. truss wire. Truss wires welded to tapered collars at the corners. Plastic split sleeves fit within shelf collars and wedge into 1" incremented grooves on posts. Each unit constructed with 74 5/8" high posts, (4) shelves high, with all standard parts and accessories necessary for a complete installation. Provide ?S?

clips at interior corners avoiding interior corner posts. Provide shelving comprised of the following;

Three (3) units 18"W. x 36"L.

Two (2) units 18"W. x 48"L.

Four (4) units 24"W. x 36"L.

Specification based on Intermetro Industries Corp. model Super Erecta wire shelving with Super Erecta Brite zinc finish.

Item #405 - Mobile (2) Shelf Dish Truck (3 Only):

Three only provide double shelf all stainless steel dish truck; overall 39-1/8"L. x 22-5/8"D. x 31-1/2"H. on 5" swivel casters. 400 lbs capacity; flat bottom shelf; sloped dish shelf to hold china in place; maximum dish size 16 1/4"; holds up to (200) 9" plates.

Specification base on Lakeside model 407.

Item #406 - Misc. Plate / Silver / Chafer Storage (10 Only):

Ten only provide adjustable wall hung cantilever wire shelving. Supports 400 lbs. per shelf from wall secured standards. Standards constructed of #11 GA. cold rolled steel in a ?U? shape with each open leg punched on 2-1/4" centers with a key hole; back of ?U? punched to allow wall installation. Wire shelves are #8 GA. cross wires spaced on 1-1/6" centers with .283" cross braces on 6" centers running perpendicular to cross wires. Cross braces welded each end inside leg of perimeter 5/8" x 1-1/4" x .105"Thick channel. All contact points welded. Each shelf includes (2) #11 GA. support arms having (2) each rivets to interlock with wall standards. Shelves, support arms and standards finished with hard baked electrostatically applied gray plastic epoxy resin after fabrication. Provide as shown, Two shelves per unit on 36"H. standards for dry environment walls. Bottom of standard installed at 36" AFF. Provide the following shelves;

Nine (9) units 18" x 48"

One (1) units 18" x 42"

Specification based on Amco Mod-A-Flex wall supported shelving, MXD36GR standards, MX1848GR & MX8142GR shelves.

Item #407 - Not Used

Item #408 - Janitorial Shelving (2 Only):

Two only provide same as Item 404.

Two (2) units 18"W. x 42"L.

Item #409 - Bulk Storage Pallets (5 Only):

Five only provide platform dunnage pallets, constructed with hi-tensil extruded 1-1/2" x 1-3/4" x .070 wall aluminum tube, all heli-arc welded, feet capped, 2,000 to 4,000 lb. average weight capacity, all units 8"H. Provide the following;

One (1) 18" x 36"

One (1) 24" x 36".

Three (3) 24" x 48".

Specification based on New-Age Dunage Racks, model 2001, 2014, 2015.

Item #410 - Silver Dispensing Carts (3 Only):

Three only provide dbl. shelf cylinder type silverware cart. 1" - 16 ga. stainless steel tubular frame with 3/4" crossrails. (2)-14 ga. stainless steel shelves welded to frame with (15) round openings in each shelf for silver ware cylinders. 4" swivel casters.

Specification based on Servolift Eastern Corporation model no. 719.

Item #411 - Mop Sink:

By other Trades.

Item #412 - Relocated Glass Rack Carts (10 Only):

Ten only relocate Servolift Eastern model 52 mobile cantilever style lowerator glass rack carts; overall 21"W. x 27"D. x 36"H.

Item #413 - Relocated Dish Carts (3 Only):

Three only relocate Lakeside model 407, same as Item No. 405.

Item #414 - Mobile Chafing / Serving Wares Shelving (2 Only):

Two only provide mobile storage shelving. Horizontal shelf frames and posts constructed of abrasion resistant epoxy finish on electroplated steel. Removable injection molded polyproplene mats set atop horizontal frames. Reinforced nylon wedges fit 1" incremented post grooves to secure shelf frames in position. Quick release locks in corners allow easy shelf adjustment. Units comprised of;

Four (4) open grid mat shelves, 24"W. x 48"L. with frame and wedge lock connectors.

Four (4) posts, 75-1/2"H.

Four (4) stem swivel casters, (2) with brakes.

Specification based on Intermetro MetroMax Q storage system with Q2448G shelves, Q74UPE posts.

Item #415 - Office Furnishings (1 Lot Only):

One lot only by Owner

Item #416 - Air Curtain:

One only provide dual motor, (2) speed non-heated air curtain; overall 60"W. x 12-3/4"D. x 14-3/4"H. Produces at the nozzle; Max. FPM 2720 & 4080; Max. CFM 3400 & 5100. Self contained one piece housing; fire retardant and corrosion proof housing; (2)-1/2HP double extended shaft motors; direct drive double width and double inlet squirrel cage blower wheels and fan housing; adjustable

air deflectors; air intake protected against inclement weather. Wired for 115V, 1PH, 1HP. Provide with the following options;

Micro Switch for automatic door actuated on/off control.

Control Panel.

Speed control.

Specification based on Mars model 60-2 Combi

PART 6 ITEMS TO BE SCRAPED

D-1 Two (2) Chefs Line S/s Enclosed Base Plate Storage Cabinets W/ Sliding Doors, Dbl. Elevated Shelves

D-2 One (1) Chefs Line Alto-Shamm Dbl. Cavity Hot Food Holding Cabinet

D-3 One (1) Chefs Line Delfield Mobile Refrigerator W/ ? Doors

D-5 One (1) Chefs Line Approx. 24"W S/S Mobile Table W/ Under Shelf

D-6 One (1) Chefs Line Delfield Salad Top Dbl. Door Refrigerated Base W/ Cutting Board

D-7 One (1) Chefs Line S/S Semi-enclosed Base Work Table W/ Toastmaster un Warmers, Sink

D-8 One (1) Chefs Line (5) Well Hot Food Unit

D-9 One (1) McCall (3) Section S/S Reach-in Refrigerator W/ ? Doors

D-10 One (1) (1) Section Reach-in Refrigerator W/ ? Doors (adjacent to d-9)

D-11 One (1) Wolf 36" Heavy Duty Top Fired Broiler W/ Cabinet Base

D-12 One (1) Blue Door Cres-Cor Mobile ?Refrigerated? Cabinet

D-13 One (1) Wolf 36" Range Match Char Broiled W/ Cabinet Base

D-14 One (1) Wolf 36" Heavy Duty Gas Range w/ Std. Oven Base

D-15 One (1) Market Forge 30 gal. Braising Pan

D-16 One (1) Alto-Shamm Dbl. Cavity Smoker

D-17 One (1) ?J? Shaped Soiled Dish Table

D-18 One (1) Soiled Dish Table Disposal

D-19 One (1) Hobart 66" Dish Machine

D-20 One (1) Clean Dish Table

D-21 One (1) White (3) Section Full Door McCall Reach-in Refrigerator

D-22 One (1) Tan / Older Manitowac Ice Cuber and Bin

D-23 Two (2) 36" Griddles

DIVISION 12 – FURNISHINGS

12510 Venetian Blinds
12511 Vertical Louver Blinds
12690 Floor Mats and Frames

DIVISION 12 - FURNISHINGS

SECTION 12510

VENETIAN BLINDS

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of venetian blinds required in this project.

1.2 APPLICABLE PUBLICATIONS: The Federal Specification (FS) listed below forms a part of this section to the extent referenced. The publication is referred to by basic designation only. The publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

AA-V-200 Venetian Blinds.

1.3 SUBMITTALS:

1.3.1 List of Materials: The Contractor shall submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: The Contractor shall submit color samples for selection of colors.

1.3.3 Installation Instructions: The Contractor shall submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturer's regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 VENETIAN BLINDS: Venetian blinds shall conform to FS AA-V-200 and the requirements herein.

2.2.1 Materials and Components:

2.2.1.1 Headrail: Manufacturer's standard headrail, channel-shaped section fabricated from minimum 0.020-inch thick sheet steel. Increase metal thickness as recommended by the manufacturer for large blind units. Cross-brace for extra rigidity. Furnish complete with tilting mechanism, top and end brace, top cradle, cord lock, and accessory items required for the type of blind and installation indicated.

2.2.1.2 Bottom Rail: Manufacturer's standard tubular steel bottom rail, designed to withstand twisting or sagging. Contour top surface to match slat curvature, with flat or slightly curved bottom. Close ends with manufacturer's standard metal or plastic end caps, of the same color as rail. Finish rail the same color as slats, unless otherwise indicated.

2.2.1.3 Slats: Manufacturer's standard, spring-tempered slats (louver blades), with rounded corners and forming burrs removed, as follows:

2.2.1.3.1 Aluminum slants not less than 0.010 inch thick.

2.2.1.3.2 Provide 1-inch narrow slats, with other components sized to suit.

2.2.1.4 Braided Ladders: Manufacturer's standard polyester support cords with integrally braided ladder rungs. Provide cord size and rung spacing as required for each type of blind shown.

2.2.1.5 Tilter: Furnish wand (or rod) type tilter consisting of standard tilter mechanism adopted for rotating wand operation. Furnish manufacturer's standard plastic or aluminum rod of proper length to suit blind installation.

2.2.1.6 Cords: Manufacturer's standard braided polyester or nylon cords, sized to suit blind type, equipped with soft-molded plastic, rubber or composition tassels securely attached to each cord end.

2.2.1.7 Cord Locks: Manufacturer's standard cord locks as required for each type of blind.

2.2.1.8 Cord Equalizers: Nylon, self-aligning type, designed to maintain horizontal blind position.

2.2.1.9 Finish: Galvanize and phosphate coat all steel parts, followed by manufacturer's standard glass-smooth, baked-on synthetic resin enamel finish. Prime aluminum slats with chromate conversion coating, followed by manufacturer's standard glass-smooth, baked-on synthetic resin enamel finish.

2.2.2 Fabrication and Operation: Prior to fabrication, verify actual opening dimensions by accurate site measurements. Adjust blind dimensions for proper fit in all openings. Fabricate components of blinds from noncorrosive, nonstaining, nonfading materials which are completely compatible with each other, and which do not require lubrication during normal expected life. Space supporting tapes or cords in accordance with manufacturer's standards, unless otherwise indicated. Space louver blades (slats) to provide overlap for light exclusion when in the fully closed position. Equip blind units, unless otherwise indicated, for the following operation:

2.2.2.1 Full-tilting operation with slats rotating approximately 180 degrees. Place tilt operating controls on left-hand side of blind units.

2.2.2.2 Full-height raising, to manufacturer's minimum stacking dimension, with lifting cord locks for stopping blinds at any point of ascending or descending travel. Place pull cords on right-hand side of blind units.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install venetian blinds as indicated on the plans and specified herein.

3.2 INSTALLATION: Installation of venetian blinds shall be accomplished in accordance with the manufacturer's written instructions. Install blinds level and plumb and adjust components for proper operation. Provide intermediate supports at intervals to permit easy entrance and removal of head, and to ensure level head and slat position. Provide adequate clearance between sash and divisions between blinds to permit unencumbered operation of sash hardware.

DIVISION 12 - FURNISHINGS

SECTION 12511

VERTICAL LOUVER BLINDS

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation, replacement and repair of vertical blinds required in this contract.

1.2 APPLICABLE PUBLICATIONS: None.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: Submit color samples for selection of colors.

1.3.3 Installation Instructions: Submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturer's regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 VERTICAL LOUVER BLINDS: Vertical blinds shall be capable of nominally 180 degree partial rotating operation 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 or wall mounted with outside or inside brackets as required. Blinds shall be sill or floor length as ordered. Outside mount installation shall provide adequate overlap to control light and privacy. Colors shall be selected from the manufacturer's standard colors using color samples provided by the Contractor.

2.2.1 Vanes: Solid vinyl vanes with clear edge groovers shall be fire resistant, UV stable, impact resistant, and shall not emit corrosive fumes in a fire. Floor length vanes shall have a bottom chain. Sill length vanes shall hang without a chain. Vanes shall overlap not less than 0.375 inch (10 mm).

2.2.1.1 Edge Groover Inserts: Vanes shall have a decorative fabric insert on both faces that slide into the clear edge groovers. Inserts shall be approved equal to Levolor color "Parchment", 84409, pattern "Kismet".

2.2.2 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.

2.2.3 Heading System: Heading system shall be not less than 0.047 inch (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 a one-touch wand control for traversing and tilting.

2.2.4 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 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.

2.2.5 Controls: Tilting traversing control shall be accomplished with a single wand that hangs compactly at the right or left side of the blinds as required and reach within 5.0 feet (1.5 m) of the floor. The tilting control shall tilt all vanes simultaneously to any desired angle and hold them at that angle. The vanes shall traverse one way to the right or one way to the left with all blinds in the same being oriented alike. The vanes shall be traversed along the head by pulling one side with the wand.

2.2.6 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.

2.2.7 Intermediate Brackets: Intermediate installation brackets shall be furnished for blinds over 42 inches (1.05 m) wide.

PART 3 EXECUTION

3.1 GENERAL: Install vertical blinds as indicated on the plans and specified herein.

3.2 INSTALLATION: Install vertical blinds in accordance with the manufacturer’s written instructions. Provide intermediate supports at intervals to permit easy entrance and removal of head, and to ensure level head and slat position. Provide adequate clearance between sash and diversions between blinds to permit unencumbered operation of sash hardware.

DIVISION 12 - FURNISHINGS

SECTION 12690

FLOOR MATS AND FRAMES

PART 1 GENERAL

1.1 SCOPE: The work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of fllor mats and frames required in this project.

1.2 APPLICABLE PUBLICATIONS: The American Society for Testing and Materials (ASTM) publication listed below forms a part of this section to the extent referenced. Publication is referred to in the text by basic designation only. Publication shall be assumed to be the most current edition in effect at the time a contract is awarded.

B221	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

1.3 SUBMITTALS:

1.3.1 Product Data: In accordance with SECTION 01300, SUBMITTALS, submit product data for each type of floor mat and frame specified, including manufacturer's specifications and installation instructions, details of construction relative to materials, dimensions of individual components, profiles, and finishes.

1.3.2 Samples: In accordance with SECTION 01300, SUBMITTALS, submit samples for verification purposes in form of 12-inch-square assembled section of floor mat and frame members with selected tread surface showing each type of finish and color of exposed floor mat, frames, and accessories required. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.

1.4 PROJECT CONDITIONS: Check actual blocked-out openings in floors by accurate field measurements before fabrication of frames and mats. Coordinate fabrication schedule with construction progress to avoid delay of work.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturer's regularly engaged in the production of the items, and the most current formula which conforms to requirements specified.

2.2 FLOOR MATS:

2.2.1 Roll-Up-Type Aluminum Floor Mats: Provide manufacturer's standard extruded aluminum, hinged tread-slat mat system, with slotted hinges of vinyl to form 2-inch wide by 3/8-inch thick slat modules, with top-surface tread inserts, continuous vinyl cushions on bottom surface of slats, and vinyl edge accessories to accommodate frame application as indicated. Provide type of tread inserts and aluminum finish as specified below similar in appearance and performance to Balco Type FMC-S or C-S Group “Pedimat.”

2.2.1.1 Tread Surface: Fusion-bonded carpet insert of 1/4-inch high, 28 ounces per square yard level-cut DuPont "Antron III" nylon filament or equal. Color as selected from manufacturer's standards by Contracting Officer.

2.2.1.2 Aluminum Finish: Dark bronze anodized finish.

2.2.2 Fabrication:

2.2.2.1 Shop fabricate units of floor mat work to greatest extent possible in sizes as indicated. Where not otherwise indicated, provide single unit for each mat installation, but do not exceed manufacturer's maximum size recommendation for removal and cleaning.

2.2.2.2 Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints. Where possible, verify sizes by field measurement before shop fabrication.

PART 3 EXECUTION

3.1 GENERAL: The Contractor shall install floor mats and frames as indicated on the plans and specified herein.

3.2 INSTALLATION:

3.2.1 Install mats to comply with manufacturer's instructions, at locations indicated.

3.2.2 Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with doors that swing across mats to provide under-door clearance.

3.3 PROTECTION: Defer installation of floor mats until near time of Substantial Completion for project.

DIVISION 13 – SPECIAL CONSTRUCTION

13930 Wet Pipe Sprinkler System, Fire Protection

SECTION 13930

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

PART 1 GENERAL

1.1 **SCOPE:** Work covered by this section includes furnishing all plant, labor, equipment, materials and transportation necessary for the installation of wet pipe sprinkler system required in this project.

1.2 APPLICABLE PUBLICATIONS: 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.

1.**2.1 American Society for Testing and Materials (ASTM):**

ASTM A 47	(1990; R 1995) Ferritic Malleable Iron Castings
ASTM A 47M	(1999) Ferritic Malleable Iron Castings Metric)
ASTM A 53	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 135	(1997c) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1983; R 1998) Carbon Steel Track Bolts and Nuts
ASTM A 536	(1999el) Ductile Iron Castings
ASTM A 795	(1997) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 88	(1996) Seamless Copper Water Tube
ASTM B 88M	(1996) Seamless Copper Water Tube (Metric)
ASTM F 442/F 442M	(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)

1.2.2 ASME International:

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.4	(1998) Cast Iron Threaded Fittings

ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) 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; B16.22a1998) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B18.2.1	(1996) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)

1.2.3 American Society of Sanitary Engineering for Plumbing and Sanitary Research (ASSE):

ASSE 1015	(1993) Double Check Backflow Prevention Assembly

1.2.4 American Water Works Association (AWWA):

AWWA EWW	(1995) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(1992) Hypochlorites
AWWA B301	(1992) Liquid Chlorine
AWWA C104	(1995) 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	(1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C203	(1997) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

1.2.5 Factory Mutual Engineering and Research (FM):

FM P7825a	(1998) Approval Guide Fire Protection
FM P7825b	(1998) Approval Guide Electrical Equipment

1.2.6 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):

MSS SP-71	(1997) Cast Iron Swing Check Valves, Flanges and Threaded Ends

1.2.7 National Fire Protection Association (NFPA):

NFPA 13	(1999) Installation of Sprinkler Systems
NFPA 13R	(1999) Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height
NFPA 24	(1995) Installation of Private Fire Service Mains and Their Appurtenances
NFPA 1963	(1998) Fire Hose Connections

1.2.8 National Institute for Certification in Engineering Technologies (NICET):

NICET 1014-7	(1995) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

1.2.9 Underwriters Laboratories (UL):

UL 668	(1995; Rev thru Dec 1998) Hose Valves For Fire Protection Service
UL Bld Mat Dir	(1999) Building Materials Directory
UL Fire Prot Dir	(1999) Fire Protection Equipment Directory

1.3 GENERAL REQUIREMENTS: A Wet pipe sprinkler system shall be provided in all areas of Building 446 as indicated on the sprinkler system design drawings. The system shall be designed and installed in accordance with NFPA 13. All sprinkler pipe sizes have been determined by hydraulic calculation. The Contractor is responsible for the sprinkler system including exact locations of sprinklers, piping and equipment. The design of the sprinkler system shall be based on hydraulic calculations, the design drawings and the other provisions specified herein.

1.3.1 Hydraulic Design: The system is hydraulically designed to discharge a minimum density of 4.07 L/min/m^2 over the hydraulically most demanding 278.7 square meters of floor area for light hazard areas; 6.11 L/min/m^2 over the hydraulically most demanding 278.7 square meters of floor area for Ordinary Hazard, Group 1 areas; 8.15 L/min/m^2 over the hydraulically most demanding 278.7 square meters of floor area for Ordinary Hazard, Group 2 areas; 12.22

L/min/m^2 over the hydraulically most demanding 278.7 square meters of floor area for Extra Hazard, Group 1 areas; and 16.29 L/min/m^2 over the hydraulically most demanding 278.7 square meters of floor area for Extra Hazard, Group 2 areas. The minimum pipe size for branch lines in gridded systems shall be 32 mm (1¼ inch). Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13.

1.3.1.1 Hose Demand: An allowance for exterior hose streams of 946.25 L/min shall be added to the sprinkler system demand at the point of connection to the existing system for Light Hazard systems; 1892.5 L/min shall be added to the sprinkler system demand at the point of connection to the existing system for Ordinary Hazard sprinkler systems; and 2838.75 L/min shall be added to the sprinkler system demand at the point of connection to the existing system for Extra Hazard sprinkler systems.

1.3.1.2 Basis for Calculations: The design of the system shall be based upon a water supply with a static pressure of 80 psi, and a flow of 1,155 gpm at a residual pressure of 66 psi. Water supply shall be presumed available at the point of connection to existing water main. 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.

1.3.2 Sprinkler Spacing: Sprinklers shall be uniformly spaced on branch lines. Coverage per sprinkler shall be in accordance with NFPA 13, except coverage per sprinkler shall not exceed 225 square feet for light Hazard Areas and 130 square feet for Ordinary Hazard areas.

1.4 COORDINATION OF TRADES: Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinkler shall be installed over and under ducts, piping and platforms when such equipment can negatively effect or disrupt the sprinkler discharge pattern and coverage.

1.5 DELIVERY AND STORAGE: All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.6 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.

1.7 SUBMITTALS: Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.7.1 Shop Drawings:

1.7.1.1 Sprinkler System Shop Drawings: Six (6) copies of the Sprinkler System Shop Drawings, no later than 21 days prior to the start of sprinkler system installation. The Sprinkler System Shop Drawings shall conform to the requirements established for working plans as prescribed in the 1999 Edition of NFPA 13, Chapter 8. Drawings shall include plan and elevation views

demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. The design drawings associated with these specifications are not intended as shop drawings but serve as a reference for pipe sizing, general pipe routing and layout, and basic system configuration. The Contractor is to provide a complete shop drawing submittal, including all information required by NFPA 13. Each set of drawings shall include the following:

1.7.1.1.1 Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

1.7.1.1.2 Floor plans drawn to a scale not less than 1/8" = 1'-0" 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 reducing couplings, and welded joints shall be indicated.

1.7.1.1.3 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.

1.7.1.1.4 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.

1.7.1.1.5 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.

1.7.1.2 As-Built Shop Drawings: As-built shop drawings, at least 14 days after completion of the Final Tests. The Sprinkler System Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film. One copy of electronic copies of the AS-built drawings shall also be submitted.

1.7.2 Product Data:

1.7.2.1 Fire Protection Related Submittals: A list of the Fire Protection Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist.

1.7.2.2 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.

1.7.2.3 Components and Equipment Data: Manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided.

1.7.2.4 Hydraulic Calculations: Since the systems have been hydraulically calculated by the Engineer, the Contractor is not required to perform hydraulic calculations. Piping layout deviations (plus or minus 18 inches and the necessary fittings) can be performed by the Contractor with authorization from the Engineer to avoid unidentified interferences. A minimum 10% safety factor shall be maintained, unless specifically approved by the Engineer. Otherwise, no changes in pipe size, pipe arrangement, or the addition or elimination of sprinklers shall be made in the field without prior approval of revised hydraulic calculations.

1.7.2.5 Spare Parts: 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.

1.7.2.6 Preliminary Tests Procedures: Proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests.

1.7.2.7 Final Acceptance Test Procedures: Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests.

1.7.2.8 On-site Training Schedule: Proposed On-site Training schedule, at least 14 days prior to the start of related training.

1.7.2.9 Preliminary Tests: Proposed date and time to begin Preliminary Tests, submitted with the Preliminary Tests Procedures.

1.7.2.10 Final Acceptance Test: Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. 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.

1.7.2.11 Fire Protection Specialist Qualifications: The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system drawings and hydraulic calculations.

1.7.2.12 Sprinkler System Installer Qualifications: The name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

1.7.3 Test Reports:

1.7.3.1 Preliminary Tests Report: Six (6) copies of the completed Preliminary Tests Reports, no later that 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

1.7.3.2 Final Acceptance Test Report: Six (6) copies of the completed Final Acceptance Tests Reports, no later that 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist.

1.7.4 Certificates:

1.7.4.1 Fire Protection Specialist Inspection: Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

1.7.5 Operation and Maintenance Data:

1.7.5.1 Sprinkler System: Six (6) manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days 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 on-site response to a service call on an emergency basis.

1.8 HYDRAULIC CALCULATIONS: Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. 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.

1.9 FIRE PROTECTION SPECIALIST: Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers 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 1014-7. The Fire Protection Specialist

shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 SPRINKLER SYSTEM INSTALLER QUALIFICATIONS: Work specified in this section shall be performed by the Sprinkler System Installer. The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.11 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. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

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 and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES: All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE: Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b

2.4 UNDERGROUND PIPING COMPONENTS:

2.4.1 Pipe: Piping from a point 6 inches above the floor to the point of connection to the existing water mains shall be ductile iron with a rated working pressure of 175 psi conforming to AWWA C151, with cement mortar lining conforming to AWWA C104. Piping more than 5 feet outside the building walls shall comply with Section 02510 WATER DISTRIBUTION SYSTEM.

2.4.2 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.

2.4.3 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 3 feet above finished grade. Gate valves and indicator posts shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.5 ABOVEGROUND PIPING COMPONENTS: Aboveground piping shall be steel.

2.5.1 Steel Piping Components:

2.5.1.1 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. All piping smaller than 2 ½ inches shall be Schedule 40 piping. 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. Galvanized pipe shall be used in all dry pipe sprinkler systems.

2.5.1.2 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. [Steel press fittings shall be approved for fire protection systems.] Galvanized fittings shall be used for piping systems or portions of piping systems utilizing galvanized piping. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.5.1.3 Grooved Mechanical Joints and Fittings: Joints and fittings shall be designed for not less than 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. All piping 2 inches and smaller shall be threaded.

2.5.1.4 Flanges: Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 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.

2.5.2 Pipe Hangers: Hangers shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b and of the type suitable for the application, construction, and pipe type and sized to be supported.

2.5.3 Valves:

2.5.3.1 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 Fire Prot Dir or FM P7825a and FM P7825b.

2.5.3.2 Check Valve: Check valve 2 inches and larger shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b. Check valves 4 inches and larger shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.6 ALARM CHECK VALVE ASSEMBLY: Assembly shall include an alarm check valve, standard trim piping, pressure gauges, bypass, retarding chamber, testing valves, main drain, and other components as required for a fully operational system.

2.7 DRY PIPE VALVE ASSEMBLY: The dry pipe valve shall be a latching differential type listed in UL Fire Prot Dir or FM P7825a and FM P7825b and shall be complete with trim piping, valves, fittings, pressure gauges, priming water fill cup, velocity drip check, drip cup, and other ancillary components as required for proper operation. The assembly shall include a quick-opening device by the same manufacturer as the dry pipe valve for systems over 500 gallons in capacity.

2.8 SUPERVISORY AIR SYSTEM: Air supply system shall be in accordance with NFPA 13. The connection pipe from the air compressor shall not be less than 1/2 inch in diameter and shall enter the system above the priming water level of the dry pipe valve. A check valve shall be installed in the system supply air piping from the compressor. A shutoff valve of the renewable disc type shall be installed upstream of this check valve. The air supply system shall be sized to pressurize the sprinkler system to 40 psi within 20 minutes.

2.9 AIR COMPRESSOR: Compressor shall be single stage oil-free type, air-cooled, electric-motor driven, equipped with a check valve, shutoff valve and pressure switch for automatic starting and stopping. Pressure switch shall be factory set to start the compressor at 30 psi and stop it at 40 psi. A safety relief valve, set to operate at 65 psi, shall be provided.

2.10 AIR PRESSURE MAINTENANCE DEVICE: Device shall be a pressure regulator that automatically reduces supply air to provide the pressure required to be maintained in the piping system. The device shall have a cast bronze body and valve housing complete with diaphragm assembly, spring, filter, ball check to prevent backflow, 1/16 inch restriction to prevent rapid pressurization of the system, and adjustment screw. The device shall be capable of reducing an inlet pressure of up to 100 psig to a fixed outlet pressure adjustable to 10 psig.

2.11 Air Supply Piping System: System shall be configured so that each dry pipe system is equipped with a separate pressure maintenance device, air compressor, shutoff valve, bypass valve and pressure gauge. Piping shall be galvanized steel in accordance with ASTM A 795 or ASTM A 53.

2.12 Low Air Pressure Alarm Device: Each dry pipe valve trim shall be provided with a low air pressure switch connected to the building fire alarm system. Upon reduction of sprinkler system pressure to approximately 10 psig above the dry valve trip point pressure, the low air pressure switch shall send a supervisory signal to the building fire alarm control panel. The low air pressure switch shall include a metal housing with a neoprene diaphragm, SPDT snap action switches and a 1/2 inch NPT male pipe thread.

2.13 WATERFLOW ALARM: Electrically operated, exterior-mounted, waterflow alarm bell shall be provided and installed in accordance with NFPA 13. Waterflow alarm bell shall be rated 24 VDC and shall be connected to the Fire Alarm Control Panel(FACP) in accordance with Section 13851 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE.

2.14 ALARM INITIATING AND SUPERVISORY DEVICES:

2.14.1 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 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 be tamper resistant and contain two SPDT (Form C) contacts arranged to transfer upon removal of the housing cover, 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.

2.14.2 Sprinkler Pressure (Waterflow) Alarm Switch: Pressure switch shall include a metal housing with a neoprene diaphragm, SPDT snap action switches and a 1/2 inch NPT male pipe thread. The switch shall have a maximum service pressure rating of 175 psi. There shall be two SPDT (Form C) contacts factory adjusted to operate at 4 to 8 psi. The switch shall be capable of being mounted in any position in the alarm line trim piping of the alarm check valve.

2.14.3 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.

2.15 FIRE DEPARTMENT CONNECTION: Fire department connection shall be flush type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a chromium plated finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 2-1/2 inch diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

2.16 SPRINKLERS: Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed spacing limitations. Temperature classification shall be as indicated or as in accordance with NFPA 13. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Sprinklers installed in light hazard areas shall be quick response sprinklers.

2.16.1 Semi-Recessed Sprinkler: Semi-recessed sprinkler shall be chrome-plated or white polyester quick-response type and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.16.2 Pendent Sprinkler: Pendent sprinkler shall be of the fusible strut or glass bulb type, type with nominal 1/2 inch or 17/32 inch orifice.

2.16.3 Upright Sprinkler: Upright sprinkler shall be brass quick-response or standard response type and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.16.4 Sidewall Sprinkler: Sidewall sprinkler shall have a nominal 1/2 inch orifice. Sidewall sprinkler shall have a white polyester finish. Sidewall sprinkler shall be the quick-response type.

2.16.5 Corrosion Resistant Sprinkler: Corrosion resistant sprinkler shall be the upright or pendent type installed in locations as indicated. Corrosion resistant coatings shall be factory-applied by the sprinkler manufacturer.

2.17 DISINFECTING MATERIALS:

2.17.1 Liquid Chlorine: Liquid chlorine shall conform to AWWA B301.

2.17.2 Hypochlorites: Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.18 ACCESSORIES:

2.18.1 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.

2.18.2 Pendent Sprinkler Escutcheon: Escutcheon shall be one-piece metallic type with a depth of less than 3/4 inch and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.18.3 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.

2.18.4 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 indicated.

2.18.5 Identification Sign: Valve identification sign shall be minimum 6 inches wide x 2 inches high with enamel baked finish on minimum 18 gauge steel or 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.

2.19 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLY: Double-check backflow prevention assembly shall comply with ASSE 1015. The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include pressure gauge test ports and OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 175 psi. The maximum pressure loss shall be 6 psi at a flow rate equal to the sprinkler water demand, at the location of the assembly. A test port for a pressure gauge shall be provided both upstream and downstream of the double check backflow prevention assembly valves.

PART 3 EXECUTION

3.1 FIRE PROTECTION RELATED SUBMITTALS: The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation of the sprinkler systems(s). The

submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSTALLATION REQUIREMENTS: The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein.

3.3 INSPECTION BY FIRE PROTECTION SPECIALIST : The Fire Protection Specialist shall inspect the sprinkler system periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements. The Fire Protection Specialist shall witness the preliminary and final tests, and shall sign the test results. The Fire Protection Specialist, after completion of the system inspections and a successful final test, shall certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.4 ABOVEGROUND PIPING INSTALLATION:

3.4.1 Protection of Piping Against Earthquake Damage: The system piping shall be protected against damage from earthquakes. Seismic protection shall include flexible and rigid couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by NFPA 13 for protection of piping against damage from earthquakes.

3.4.2 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.

3.4.3 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.

3.4.4 Pendent Sprinklers: Drop nipples to pendent sprinklers shall consist of minimum 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 12 inches.

3.4.4.1 Pendent Sprinkler Locations: Pendent sprinklers in suspended ceilings shall be a minimum of 6 inches from ceiling grid.

3.4.5 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 30 inches in length shall be individually supported.

3.4.6 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.

3.4.7 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 1/2 inch.

3.4.8 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 penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07840 FIRESTOPPING. In penetrations that 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 that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.4.9 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.

3.4.10 Inspector's Test Connection: Unless otherwise indicated, test connection shall consist of 1 inch pipe connected to the remote branch line; a test valve located approximately 7 feet 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.

3.4.11 Drains: Main drain piping shall be provided to discharge at a safe point outside the building. Auxiliary drains shall be provided as indicated and as required by NFPA 13. When the capacity of trapped sections of pipe is less than 3 gallons, the auxiliary drain shall consist of a valve not smaller than 1/2 inch and a plug or nipple and cap. When the capacity of trapped sections of piping is more than 3 gallons, the auxiliary drain shall consist of two 1 inch valves and one 2 x 12 inch condensate nipple or equivalent, located in an accessible location. Tie-in drains shall be provided for multiple adjacent trapped branch pipes and shall be a minimum of 1 inch in diameter. Tie-in drain lines shall be pitched a minimum of 1/2 inch per 10 feet.

3.4.12 Installation of Fire Department Connection: Connection shall be mounted on the exterior wall approximately 3 feet above finished grade. 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.

3.4.13 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.

3.5 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 4 feet. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 6 inches 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 5 feet outside the building walls shall meet the requirements of Section 02510 WATER DISTRIBUTION SYSTEM.

3.6 EARTHWORK: Earthwork shall be performed in accordance with applicable provisions of Section 02316 EXCAVATION, FILLING AND BACKFILLING FOR UTILITIES.

3.7 ELECTRICAL WORK: Except as modified herein, electric equipment and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE. All wiring for supervisory and alarm circuits shall be #16 AWG solid copper installed in metallic tubing or conduit. Wiring color code shall remain uniform throughout the system.

3.8 DISINFECTION: After all system components are installed and hydrostatic test(s) are successfully completed, each portion of the sprinkler system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. Flushing shall be conducted by removing the flushing fitting of the cross mains and of the grid branch lines, and then back-flushing through the sprinkler main drains. 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 if 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 then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected 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 EWW. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection 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. After the successful completion, all sprinklers or plugs and gravity flush all drops or trapped piping.

3.9 PIPE COLOR CODE MARKING: Color code marking of piping shall be as specified in Section 09900 PAINTING, GENERAL. All exposed sprinkler pipe shall be painted red.

3.10 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. The preliminary test shall include the same items as indicated for the final test. The preliminary tests shall be coordinated with the base fire chief. The preliminary test shall be coordinated with fire alarm system testing so both systems can be tested at the same time.

3.10.1 Underground Piping:

3.10.1.1 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.

3.10.1.2 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 2 quarts per hour per 100 gaskets or joints, regardless of pipe diameter.

3.10.2 Aboveground Piping:

3.10.2.1 Hydrostatic Testing: Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 200 psi or 50 psi 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.

3.10.2.2 Backflow Prevention Assembly Forward Flow Test: Each backflow prevention assembly shall be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. The Contractor shall provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5 inch diameter hoses, playpipe nozzles, calibrated pressure gauges, and pitot tube gauge. The Contractor shall provide all

necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction) across the assembly shall be recorded. A metal placard shall be provided on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate. The pressure drop shall be compared to the manufacturer's data.

3.10.3 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.

3.10.4 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.

3.11 FINAL ACCEPTANCE TEST: Final Acceptance Test shall begin only when the Preliminary Test Report has been approved. The Fire Protection Specialist shall conduct the Final Acceptance Test 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.

3.12 ON-SITE TRAINING: The Fire Protection Specialist 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 Preliminary Tests and Final Acceptance Test. The On-Site Training shall cover all of the items contained in the approved Operating and Maintenance Instructions.

DIVISION 14 – CONVEYING SYSTEMS

14240 Passenger Elevator

DIVISION 14 – CONVEYING SYSTEMS

SECTION 14240

HYDRAULIC ELEVATORS

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation, replacement and repair of hydraulic elevators required in this contract.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American Society of Mechanical Engineers (ASME) Standards:

A17.1	Safety Code for Elevators and Escalators.
A17.2.2	Inspectors' Manual for Hydraulic Elevators.
B16.11	Forged Fittings, Socket-Welding and Threaded.
B31.1	Power Piping.
QEI-1	Standard for the Qualification of Elevator Inspectors.

1.2.2 American Society for Testing and Materials (ASTM) Standards:

A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
A106	Seamless Carbon Steel Pipe for High-Temperature Service.
A176	Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip.
A366	Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
A568	Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled .
A569	Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality.
D92	Flash and Fire Points by Cleveland Open Cup.
E84	Surface Burning Characteristics of Building Materials.

1.2.3 Code of Federal Regulations (CFR):

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

1.2.4 Federal Standard (FStd):

795 (Basic) Uniform Federal Accessibility Standards.

1.2.5 International Conference of Building Officials (ICBO) Publication:

01 Uniform Building Code (3 Vol.).

1.2.6 National Electrical Manufacturers Association (NEMA) Standards:

LD 3 High-Pressure Decorative Laminates.

MG 1 Motors and Generators.

1.2.7 National Fire Protection Association (NFPA) Standards:

70 National Electrical Code.

252 Fire Tests of Door Assemblies.

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:

1.3.1 Data:

1.3.1.1 Training Data: Information describing the training course for operating personnel, training aids and samples of materials to be used, training schedules, and notification of training.

1.3.1.2 Elevator System: A complete list of equipment and material, including illustrations, schedules, manufacturer's descriptive data and technical literature, performance charts, catalog cuts, installation instructions, brochures, diagrams, and other information required for fabrication and installation of the equipment. Data shall include calculations for reaction loads imposed on building by elevator systems and to demonstrate that the proposed elevator system meets requirements for seismic loading of zone 1 in accordance with ICBO-01. Certified copies of list reports may be submitted in lieu of calculations. Calculations to demonstrate compliance with ASME A17.1, Rule XXIV shall be included. Spare parts data for each different item of material and equipment specified, after approval of detail drawings and not later than 2 weeks prior to date of beneficial occupancy. Data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended to be replaced and replacement interval required. Data shall include appropriate sizing of electrical protective devices.

1.3.2 Drawings:

1.3.2.1 Elevator System: Detail drawings including dimensioned layouts in plan and elevation showing the arrangement of elevator equipment, anchorage of equipment, clearances for maintenance and operation; and details on hoistway, doors and frames, operation and signal stations, controllers, motors, guide rails and brackets, cylinder and plunge unit, and points of interface with normal power fire alarm system and HVAC or exhaust systems. Drawings shall contain complete wiring diagrams showing electrical connections and

other details required to demonstrate sequence of operation and functions of system devices. Drawings shall include the appropriate sizing of electrical protective devices which are frequently different from National Electrical Code standard sizes.

1.3.3 Instructions:

1.3.3.1 Framed Instructions: Diagrams, instructions, and other sheets proposed for posting.

1.3.4 Statements:

1.3.4.1 Qualification Certificates: Certificates of experience of elevator mechanics employed to install, supervise and test the elevator shall certify mechanics to have not less than 5 years experience installing, supervising and testing elevators of the type and rating specified. Certificate shall certify that elevator system installer is acceptable to elevator manufacturer prior to installation of elevators.

1.3.5 Reports:

1.3.5.1 Testing: 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 installed system.

1.3.6 Samples:

1.3.6.1 Finishes; GA: Samples of materials and products requiring color or finish selection.

1.3.7 Records:

1.3.7.1 Test Procedures; GA: A plan detailing the testing procedures shall be submitted 60 days prior to performing the elevator tests.

1.3.8 Operation and Maintenance Manuals:

1.3.8.1 Elevator System; GA: Six copies of operation manual outlining the step-by-step procedures for system startup, operation and shutdown. Manuals shall include manufacturer's name, model number, service manual, parts list and brief description of all equipment, including basic operating features. [Six] copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Manuals shall include equipment layout and complete wiring and control diagrams of the system as installed. Operation and maintenance manuals shall be approved prior to training course.

1.4 QUALIFICATIONS: Hydraulic elevators shall be pre-engineered elevator systems, and provided by a company regularly engaged in the manufacture of elevator systems. The manufacturer shall either install the elevator system or provide letter of endorsement certifying that the elevator-system installer is acceptable to the manufacturer.

1.5 REGULATORY REQUIREMENTS: Design and fabrication shall be in accordance with ASME A17.1. Each car shall have the capacity to lift a live load, exclusive of the car, at a speed as specified in the following schedule. The

approximate travel, terminal floors, number of stops and openings, and the car sizes shall be as shown in the schedule. The elevators shall serve the floors with stops and openings in accordance with the requirements indicated. Elevators shall provide accessibility and usability for physically handicapped in accordance with the requirements for the handicapped in FED-STD 795 and 36 CFR 1191.

1.5.1 Elevator Schedule (Passenger):

Number of Elevators Required:	1
Service:	Passenger Hospital service
Capacity:	2500 pounds
Speed: (150 fpm downspeed)	80 fpm (full load up)
Platform Size:	7’-0” wide by 5’-0” deep
Clear Car Inside:	6’-0” wide by 4’-3” deep
Net Travel:	12’-0”
Landings:	2
Openings: Front	2
Openings: Rear	0

Entrance Type:
Single-speed horizontal-sliding

1.6 DESIGNATED LANDING: For the purposes of firefighter's service and emergency operations, as required by Section 211, ASME A17.1, the designated landing or level shall be the first floor. The alternate landing or level shall be the lower floor.

1.7 DELIVERY AND STORAGE: All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variations; and dirt, or other contaminants.

1.8 FIELD MEASUREMENTS: The Contractor shall become familiar with all details of the work, verify all dimensions in the field and advise the Contracting Officer of any discrepancy before performing any work.

1.9 WARRANTY: Warranty service shall be provided for each elevator for a period of 12 months after date of acceptance by Contracting Officer. Warranty service shall be performed only by trained elevator mechanics during regular working hours and shall include manufacturer's warranty requirements including but not limited to adjusting, lubricating and cleaning of equipment and furnishing supplies and parts to keep elevator in operation, except such parts made necessary by misuse, accident or negligence not caused by the Contractor. Testing and adjustments shall be in accordance with the applicable provisions of ASME A17.1 and ASME A17.2.2. Emergency callback service shall be included and available 24 hours a day, 7 days per week, with an initial telephone response time of 1 hour and a response time of [4] hours for a me-

chanic to the site. Inspection and service for fire service operation seismic requirements, shall be performed every 6 months. Documentation of inspection and testing, and certification of successful operation shall be provided with each unit.

PART 2 PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS:

2.1.1 Standard Products: Material and equipment shall be the standard products of manufacturers regularly engaged in the fabrication of elevators and/or elevator parts, and shall essentially duplicate items which have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is available 24 hours a day, 7 days per week, with a response time of 4 hours.

2.1.2 Nameplates: Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, catalog number, and electrical and mechanical characteristics on a plate secured to the item of equipment.

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 Electrical Work: Changes to the electrical distribution system required for coordination with elevator equipment shall be performed and coordinated by Contractor, at Contractor's expense. Electrical service for elevator machines shall be 208 volt, 60-Hertz, 3-phase, 4 wire solid neutral grounded alternating current. Electric service for elevator car lighting shall be 120-volt, single-phase, 60-Hertz grounded service. Electrical work shall conform to requirements in Section 16415 ELECTRICAL WORK, INTERIOR. A disconnect switch that will shut off power to the elevator car lighting shall be provided in the elevator machine room adjacent to the elevator control panel. A telephone junction box and an elevator car lighting junction box shall be provided adjacent to each controller. A single-phase electric circuit with grounded connection for video monitor shall be provided in machine room.

2.1.5 Use of Asbestos Products: Materials and products required for manufacturing and installing elevators shall not contain asbestos.

2.2 MISCELLANEOUS MATERIALS:

2.2.1 Materials for Car Enclosures: Materials for car enclosures shall meet flame spread rating 0 to 75 and smoke development 0 to 450 as tested in accordance with requirements of ASTM E 84 as established by ASME A17.1, Rule 204.2.

2.2.2 Structural Steel: Structural steel shall be hot-rolled commercial quality carbon steel, pickled, oiled, complying with ASTM A 569 and ASTM A 568.

2.2.3 Cold-Rolled Sheet Steel: Sheet steel shall be cold-rolled commercial quality low carbon steel, Class 1, exposed matte finish, oiled, complying with ASTM A 366 and ASTM A 568.

2.2.4 Stainless Steel: Stainless steel shall be ASTM A 176 Type 302/304, austenitic, corrosion-resistant, with grain of belting in the direction of longest dimension. Surfaces shall be smooth and without waves and shall be in compliance with ASTM A 366.

2.3 PASSENGER ELEVATOR CAR:

2.3.1 Car Fronts: Fronts for passenger elevators shall be combination door post and return panels manufactured of 14 gauge stainless steel provided with necessary cutouts for operating devices. Car operating panel shall be recessed into front return panel with surface-applied operating panel cover. Position indicator in front return shall be recessed with a surface-applied cover plate. Exposed stainless steel shall be finished with No. 4 Satin Finish, unless otherwise specified.

2.3.2 Car Doors: Car doors for passenger elevators shall be constructed from 16 gauge sheet steel and stainless steel cladding. Each door shall be sound-deadened and reinforced to receive required operating mechanism and hardware, and have two removable door guides per panel. Seams, screws or binding strips shall not be visible from within the car. Threshold shall be stainless steel finished with No. 4 Satin Finish, unless otherwise specified. Car doors shall be equipped with a proximity-type infrared protective device having the following operation:

2.3.2.1 When doors are in full-open position, doors shall be unable to initiate closing if a person comes within detection zone. Detection zone moves with doors, so that if a passenger or object enters the zone after doors have begun to close, doors shall stop, then reverse to reopen. Doors shall reclose after a brief time. A passenger entering or leaving cars shall not cause doors to reopen unless doors reach a predetermined proximity to passenger.

2.3.2.2 After a stop is made, doors shall remain open for a time to permit passenger transfer, after which doors shall close automatically. This time interval shall be less for a car call than for a hall call or a coincident car/hall call.

2.3.2.3 If there is either a hall call anywhere in the group or a car call in the car in question and doors are prevented from closing for a fixed time period, door protective device shall be rendered inoperative, a buzzer shall sound in car and doors shall close at approximately half speed. Normal door operation shall resume at next landing reached by car.

2.3.3 Car Platform: Car platform for passenger elevators shall be fabricated from steel plates secured to a steel frame or plywood secured to a steel frame. Steel car platforms shall be assembled into a one-piece platform with top and bottom steel plates welded to structural steel frame and covered with felt and sound-isolation. Plywood car platform shall be 3/4 inch thick Exposure 1 plywood secured to underside of structural steel frame with metal fire protection secured to underside of structural steel frame.

2.3.4 Sling: Sling for passenger elevators shall be constructed of heavy steel stiles properly affixed to a steel crosshead and bolster with adequate bracing members to remove all strain from car enclosure. Steel bumpers shall be furnished for fastening sling to plunger.

2.3.5 Walls: Walls for passenger elevators shall be 7 feet 11-1/2 inches high from floor to the underside of lighting fixtures. Side and rear panels shall be 16 gauge sheet steel panels. Lower portion of side and rear wall panels shall be provided with a 12 gauge stainless steel wainscoting from top of car base to a point 2 inches above top of handrail. Side and rear removable panels shall be applied to car walls and shall be manufactured from 3/4 inch plywood or composition board finished on front, back and edges faced with plastic laminate conforming to NEMA LD 3, general purpose type. Panels shall be mounted on car walls in a manner permitting their reversing. Panels shall be evenly spaced with not less than two panels on each side and three panels at rear with 3/8 inch separations backed up with stainless steel dividers reveal standard with manufacturer. Vent around base shall be provided concealed behind removable panels.

2.3.6 Car Top, Ceiling and Light Fixtures: Car top for passenger elevators shall be manufactured from 12 gauge sheet steel and shall be not less than 5-1/2 inches high with drop-ceiling and light fixtures. Ceiling shall be 1/8 inch thick translucent white plastic fire-retardant light diffuser supported by baked-enamel perimeter frame and dividers to form drop-ceiling light fixture. Light fixtures shall be fluorescent type flush with car ceiling, manufactured of sheet steel with flange and enclosed sides and top, baked-enamel reflector, mounted directly to outlet box. Bottom of fixtures shall be flush with car ceiling. Fluorescent light fixtures shall be dual lamp with quick-starting high-power factor, Class P ballasts with safety lamp guard clamps on fluorescent tubes. Light level shall average at least 10 foot candles measured at the car threshold, with the door closed. A part of car light fixture shall be removable to permit use of the emergency exit panel in top of car.

2.3.7 Emergency Exit: Car top for passenger elevators shall be manufactured with a hinged emergency exit panel of 12 gauge steel which opens up to clear the crosshead and car door operator. Emergency exit panel shall be hinged on counterweight side and held in place with nonremovable fastening devices at each corner, and be openable from top of car only. A minimum of two sides of exit panel shall lap exit opening by 1 inch. Exits shall be equipped with electrical contacts which will prevent operation of car when the exit door is open and cause the alarm bell to ring.

2.3.8 Floor Finish: Floor finish for passenger elevators shall be finished with carpet to match elevator lobby as specified in Section 09680 CARPETING.

2.3.9 Base: Base for passenger elevators shall be plastic laminate cove type stainless steel, 6 inches high.

2.3.10 Handrails: Handrails for passenger elevators shall be mounted on each wall and shall comply with ASME A17.1, FED-STD 795 and 36 CFR 1191.

2.3.11 Exhaust Fan: Exhaust fan for passenger elevators shall be two-speed exhaust type ventilating unit mounted in car ceiling and shall be provided with a chrome-plated steel grille. Units shall be suitably isolated from car ceiling and shall provide at top speed of a minimum of 6 air changes per hour for car volume and car occupancy. Switches for the operation of the exhaust unit shall be located in car station locked cabinet or key-switched.

2.3.12 Communications: A telephone system in stainless steel cabinets shall be provided for passenger elevators. A vandal-resistant speaker type intercom with push-buttons to activate shall be installed in car station behind a stainless steel perforated grille and connected to a programmable auto-dialer

located in machine room. Auto-dialer shall be provided with a solid-state charger unit which will automatically provide emergency power and an immediate transfer in the event of failure of normal power supply. The push-button located in car station or in separate cabinet shall be at the prescribed handicapped height and shall be identified as "EMERGENCY PHONE PUSH TO ACTIVATE". The entire communication assembly shall be approved for an elevator installation. The push button telephone shall comply with FED-STD 795 and 36 CFR 1191. The telephone communication shall not be terminated until one of the communicating parties hangs up the receiver or manually disconnects the communication link.

2.3.13 Car Emergency Lighting System: Emergency car lighting system for passenger elevators shall consist of an emergency power pack on top of the elevator and a remote lighting fixture inside elevator car located in or above car operating panel.

2.3.13.1 Power Pack: Power pack for emergency lighting system shall be a sealed lead-cadmium or nickel-cadmium 6-volt rechargeable batteries with solid-state controls and an integral regulating charger connected to normal power supply. Power pack unit shall contain the following:

2.3.13.1.1 Minimum 6 inch diameter alarm bell connected to the elevator alarm and emergency push-button.

2.3.13.1.2 Top of car light fixture with protective wire guard.

2.3.13.1.3 Testing circuit and pilot light.

2.3.13.1.4 Low-wattage pilot light indicator.

2.3.13.1.5 Battery low-voltage disconnect.

2.3.13.2 Emergency Light Fixtures: Emergency light fixture shall be located in car station inside elevator car, with flush-mounted lens and shall consist of the following:

2.3.13.2.1 A minimum of two lamps capable of providing a minimum level of illumination of 1.0 footcandle at a point 4 feet above the floor, 1 foot in front of car station.

2.3.13.2.2 Steel fixture frame with chrome finish.

2.3.13.2.3 Frosted acrylic lens, 1/4 inch.

2.3.13.3 Remote Light Fixture: Upon interruption of normal power, remote light fixture for passenger elevators shall automatically and immediately illuminate and permit operation of alarm bell, subject to activation of emergency stop-switch or alarm button. Emergency power pack shall be capable of providing a minimum of 1 hour emergency bell operation and 4 hours of continuous illumination.

2.3.14 Certificate Frame: A stainless steel certificate frame with translucent plexiglass lens of the appropriate size to receive certificate issued by inspecting agency shall be provided. Frame shall be engraved to show name of manufacturer, carrying capacity in pounds and maximum number of persons allowed.

2.3.15 Car Guide Shoes: Guide shoes for passenger elevators shall be the adjustable mounting type on each side of car. Shoes shall be rigidly secured in accurate alignment at top and bottom of car frame. Flexible type sliding guide shoes shall consist of a swivel-type shoe, assembled on a metal base with provisions for self-alignment. Each shoe shall be provided with renewable gibs. Car guide shoes shall be adjustable for side play between guide rails. Renewable wearing gibs shall be fabricated from a durable plastic compound material having a low coefficient of friction and long wearing qualities. Gibs shall be the type requiring minimum rail lubrication.

2.4 PASSENGER ELEVATOR HOISTWAY ENTRANCES:

2.4.1 Hoistway Doors: Hoistway doors for passenger elevators shall be designed and fabricated as part of a Class B 1-1/2 Hour fire-rated door/frame assembly to meet requirements of NFPA 252 and shall bear the label of an approved testing laboratory. Doors for passenger elevators shall be hollow metal type with plain panel design not less than 1-1/4 inches thick with 16 gauge face sheet-steel panels, and stainless steel cladding, with 16 gauge sight guards to match door finish. Each door shall be reinforced with continuous vertical members and filled with sound-deadening material. Doors shall be reinforced to accept the required operating mechanism and hardware. Doors shall have two removable door guides per panel. Seams, binding strips or screws shall not be visible from the landing. Exposed stainless steel shall be finished with No. 4 Satin Finish, unless otherwise specified.

2.4.2 Hoistway Frames: Hoistway frames for passenger elevators shall be designed and fabricated as part of a Class B 1-1/2 Hour fire-rated door/frame assembly to meet requirements of NFPA 252 and shall bear the label of an approved testing laboratory. Frames shall be formed 14 gauge sheet-steel with stainless steel cladding with head and jamb in flush alignment and corners welded and ground smooth. Head and jamb section shall be bolted assembly with bolts, washer and locking nut or lock washer. Frame assembly shall be securely fastened to the structure. Frames shall return to the wall. Combination buck and jamb frames may be provided with knockdown back flanges to permit installation in concrete walls. Exposed stainless steel shall be finished with No. 4 Satin Finish, unless otherwise specified.

2.4.3 Symbols: Raised stainless steel symbols as required by FED-STD 795 and 36 CFR 1191 of color selected, shall be provided at each floor to indicate the floor location. Symbols shall be attached with concealed fasteners. Symbols shall be placed in a location which can be seen by passenger from the opened passenger elevator doors.

2.4.4 Sills: Sills for passenger elevators shall be extruded aluminum with slip-resistant surface and machined grooves for door guides, secured to floor beams.

2.4.5 Strut Angles: Strut angles for passenger elevators shall be structural steel of size not less than 3 x 3 x 3/16 inch extending from sill to beam above and anchored to building structure with structural steel fastenings and bracings of structural members with a cross section of not less than strut angles.

2.4.6 Door Hangers and Housing: Each door panel shall be provided with not less than two sheave-type hangers designed for required door operation. Hanger housing and support shall be fabricated from formed Z-shaped steel angles of size not less than 3/16 inch thick bolted to strut angles.

2.4.7 Door Rollers: Door rollers shall be constructed with grease-packed ball-bearings and shall be tired with a sound-reducing material. Diameter of rollers shall not be less than 3-1/4 inches for car doors and not less than 2-1/4 inches for hoistway doors. Upward thrust shall be taken by a hardened and ground ball-bearing roller assembled on an eccentric stud to provide adjustment.

2.4.8 Hanger Track: Hanger track shall be of high carbon cold-drawn steel, round at top to receive door rollers, round at bottom to receive up-thrust rollers, of size engineered to accommodate load requirements.

2.4.9 Covers and Guards: Hanger covers, dust covers, toe guards and fascia plate shall be fabricated from 16 gauge reinforced steel and finished with baked-enamel. Hanger covers shall extend the full door travel and shall be mounted in sections for ease of servicing door hangers. Dust covers shall be provided over top terminal landing door only and shall be secured to hanger housing and building structure. Toe guards shall be secured to sill. Fascia plates shall be provided between each door hanger housing and sill.

2.5 PASSENGER ELEVATOR DOOR OPERATION: Car and hoistway doors for passenger elevators shall be operated simultaneously by an electric-power door operator. Doors shall operate smoothly in the opening direction and closing direction and be electrically or hydraulically cushioned to stop at both the full-open and full-closed position. Operators shall be high-speed heavy-duty type which will provide an average door-opening speed of 2-1/2 fps. Car and hoistway doors shall be opened and closed simultaneously in a maximum time of 2 seconds. When on automatic operation door-closing time shall not exceed 2 seconds and door-closing force shall not exceed 30 pounds. Reversal of doors when closing shall be accomplished by the "DOOR OPEN" button, car door safety edge, or interruption of the photoelectric light beams. Doors shall be arranged so that doors can be opened manually in the event of power failure.

2.6 PASSENGER ELEVATOR OPERATING AND SIGNAL FIXTURES:

2.6.1 General: Elevator fixtures and panels for passenger elevators shall be constructed of 1/8 inch thick faceplates in swing return of stainless steel. Fastenings for all exposed fixtures shall be secured with tamper-proof spanner-head screws of same material and finish as fixture. Hall and car call-buttons shall be the call-register type with a low-voltage power supply not to exceed 48 volts. Pressure on a button shall illuminate button to indicate that a call in the desired direction has been registered. Car and hall fixtures shall be designed and located at the prescribed height to accommodate the handicapped in accordance with FED-STD 795 and 36 CFR 1191 for passenger elevators only. Handicapped markings shall be integral with faceplates in accordance with FED-STD 795 and 36 CFR 1191. Surface-applied markings are not acceptable. Engraving shall be black-filled except for fire-service identification which shall be red-filled. Operating and signal fixture contacts and lamps shall be completely enclosed in steel boxes finished with a baked-enamel. Boxes for hall landing devices shall be equipped for proper adjustment to wall. Lamps shall be installed in light-tight compartments. Cover-plates shall be provided with rubber gaskets when exposed to weather or harmful contaminants. Replacement bulbs shall be readily available from three sources.

2.6.2 Car Operating Panel: Car operating panel for passenger elevators shall be provided with the necessary raised (0.03 inch) markings for the

handicapped, and shall include a series of minimum 3/4 inch diameter or square push-buttons numbered to correspond to the floor served and various additional switches, buttons and light jewels, including emergency stop, alarm button, "DOOR OPEN" button and telephone. Operating buttons shall be of manufacturer's standard design. Buttons shall have maximum protrusion of 3/16 inch beyond the faceplate and shall have beveled edges to prevent damage from side blows.] Buttons and switches not required for automatic or fire-service operation shall be key-operated and mounted on front-return car operating station. Elevator number and "NO SMOKING" shall be international symbol engraved on upper portion of car. Operating panel in car shall consist of a flush-mounted panel containing the following operating devices:

2.6.2.1 "DOOR OPEN" button.

2.6.2.2 "DOOR CLOSE" button.

2.6.2.3 Key-operated car fan/light switch.

2.6.2.4 Key-operated ventilating blower switch/call light.

2.6.2.5 Communication telephone.

2.6.2.6 Emergency stop-switch key-operated when operated will stop the car independently of normal stopping devices. Operation of emergency stop switch shall not cause any power variance or surge that may affect the operation or condition of the control panel or its components.

2.6.2.7 Emergency signal-switch connected to a 6 inch diameter signal bell outside of elevator hoistway at first floor located as shown or as directed.

2.6.2.8 Key-operated inspection switch which will render normal operation inoperative for the purpose of using the hoistway access switch.

2.6.2.9 Key-operated fire-service switch and light jewel.

2.6.3 Auxiliary Car Operating Panel: Auxiliary car operating panel for passenger elevators shall be similar in design to main car panel, and shall include all devices necessary for automatic operation such as emergency stop switch, alarm bell, "DOOR OPEN" button.

2.6.4 Hall-Call Station: Hall-call operating devices for passenger elevators at landing shall consist of an "UP" push-button at bottom landing, a "DOWN" push-button at top landing, and "UP" and "DOWN" push-buttons at all other landings. Buttons shall be manufacturer's standard design. Buttons shall be designed with 1/32 inchoperating clearance to seat on faceplate in lieu of button mechanism. Buttons shall have maximum protrusion of 3/16 inch beyond faceplate with beveled edges to prevent damage from side blows.

2.6.4.1 Commandeering Switch: Key-operated commandeering switch for passenger elevators shall be provided at each landing and located in landing call-button cover plate. Switch shall be momentary pressure type with the key removable only in "Off" position and shall be keyed to match the independent operation switch specified for car operating devices.

2.6.4.2 Fire-Service Switch: Fire-service switch for passenger elevators shall be located at the designated landing.

2.6.5 Direction Lanterns: Lanterns for passenger elevators shall be in accordance with FED-STD 795 and 36 CFR 1191 and shall be provided at all floor landings and in each car entrance column. Lanterns shall be the manufacturer's standard vandal-resistant design. Lanterns shall signal the approach of a stopping car when car is a predetermined distance from landing.

2.6.6 In-Car Car-Position Indicator: Indicator numerals and directional arrows for passenger elevators shall be flush-mounted faceplate with black-filled engraved numerals not less than 1 inch high and 3/8 inch diameter vandal-resistant light jewels directly beneath each number. As car travels through hoistway the car position shall be indicated by illumination of light jewel corresponding to landing at which the car is stopped. Necessary light baffles shall be provided.

2.6.7 Audible Signals: An audible signal shall be provided at each floor landing and in each car and shall sound coincident with the lantern illumination indicators. The audible signal shall be no less than 20 decibels with a frequency no higher than 1500 Hz. The audible signal shall sound once for UP direction and twice for DOWN direction.

2.7 PASSENGER CAR OPERATION (TWO-STOP AUTOMATIC CAR OPERATION): Passenger Elevator No. _____: The operating device at each of two hoistway landings shall consist of a single illuminating push-button. The system shall be designed for operating elevator from push-buttons at landings and car buttons marked for corresponding landings. Pressure on a car button or landing button shall dispatch or call the car to other landings if interlock circuits have been established. A call shall remain registered if a lower floor landing button is pressed while car is making an UPWARD trip. After car has reached upper landing and interlock circuits have been reestablished the car shall automatically reverse and respond to lower landing call. Elevator shall operate similarly for DOWN direction of travel. A time-limit relay shall be provided to hold the car for a predetermined period at landing where car stops. When all calls are completed the elevator shall park at last floor served. A landing button pressed momentarily at same floor at which the car is parked shall automatically open car hoistway doors.

2.8 SENSOR AND CONTROL WIRE SURGE PROTECTION: Digital and analog inputs shall be protected against surges induced on control and sensor wiring. Digital and analog outputs shall be protected as shown against surges induced on control and sensor wiring installed outdoors. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following waveforms:

2.8.1.1 A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

2.8.1.2 An eight microsecond rise time by 20 microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

2.9 COMMUNICATIONS LINKS SURGE PROTECTION: Communications equipment shall be protected against surges induced on any communications link. Cables and conductors, except fiber optics, which serve as communications links from Motor Control Room (MCR) to field equipment, and between field equipments shall have surge protection circuits installed at each end. Protection shall be furnished at equipment and additional triple electrode gas surge protectors rated for the application on each wireline circuit shall be installed within 3 feet of the building cable entrance. Fuses shall not be used for surge

protection. The inputs and outputs shall be tested in both normal mode and common mode using the following two waveforms:

2.9.1 A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

2.9.2 An eight microsecond rise time by 20 microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

2.10 COMMUNICATIONS LINKS OVER VOLTAGE PROTECTION: Communications equipment such as MODEMs, line drivers, and repeaters shall be protected against over-voltage on any communications link conductors. Cables and conductors, which serve as communications links, except fiber optics, shall have overvoltage protection for voltages up to 480 Vac rms, 60 Hz installed. Instrument fuses or fusible resistors are required for this application.

2.11 FIREFIGHTERS SERVICE: Firefighter service shall be in accordance with ASME A17.1 for automatic elevators. Elevator lobby and machine room smoke detectors shall be photoelectric spot-type smoke detectors. Smoke detectors shall be powered from the building fire alarm control panel. Elevator lobby and machine room smoke detectors shall be in accordance with Section 16721 FIRE DETECTION AND ALARM SYSTEM.

2.12 ELEVATOR POWER UNIT:

2.12.1 Pumping and Control Mechanism: Hydraulic fluid shall be provided in the reservoir, pump and control valve. Hydraulic fluid shall have a minimum fire point of 375 degrees F as established by ASTM D 92. If oil temperature drops below pre-set minimum, elevator shall be dispatched automatically to lowest terminal floor at which point the pump will bypass oil in system without car motion until pre-set temperature is reached. Normal response to passenger demand shall not be affected by this control. Resistance type heating elements do not meet the intent of this specification.

2.12.1.1 Oil Temperature Device: An oil temperature device shall be provided that will maintain oil temperature between 70 degrees and 100 degrees F regardless of ambient temperatures.

2.12.1.2 Pump: Pump shall be a rotary-positive displacement type for oil-hydraulic elevator service designed for steady discharge with minimum pulsation to give smooth and quiet operation, with an output which will not vary more than 10 percent between no-load and full-load on the elevator. Operating pressure shall not exceed 400 psi.

2.12.1.3 Piping: Piping shall be ASTM A 53 Grade E or S, ASTM A 106 Grade B, or grooved piping system of minimum schedule 40 seamless steel conforming to ASME A17.1 and ASME B16.11. Pipes shall conform to the cleanliness requirements of ASME B31.1.

2.12.1.4 Motor: Motor shall be especially designed for oil-hydraulic elevator service and shall be of standard manufacture duty rating and provided with specified speeds and loads.

2.12.1.5 Oil-Control Unit: Oil-control unit shall contain the following valve assemblies:

2.12.1.5.1 Automatic shut-off valve shall be provided in the oil-supply line as close to the cylinder inlet as possible. When there is a 10 percent drop in NO-LOAD operating pressure, the automatic shut-off valve shall be activated. When activated, the device shall immediately stop the descent of elevator and hold the elevator until it is lowered by use of the maximum lowering feature of the valve. Manual lowering feature of automatic shut-off valve shall be arranged to limit the maximum descending speed of elevator to 15 feet per minute. Exposed adjustments of automatic shut-off shall have the means of adjustment sealed after being set to the correct position.

2.12.1.5.2 Relief-valve for hydraulic shall be externally adjustable and shall bypass the total oil flow without increasing back pressure by more than 56 percent above working pressure.

2.12.1.5.3 Safety check-valve shall close quietly without permitting any perceptible reverse flow and shall be designed to support the elevator on a positively locked column of oil when car is at rest.

2.12.1.5.4 Up-start and stop valve shall be externally adjustable and shall bypass oil flow during the start-and-stop of motor-pump assembly. Valve shall close slowly, gradually diverting oil to the jack unit to insure smooth up-start and up-step.

2.12.1.5.5 Lowering and leveling valve shall be externally adjustable for drop-away speed, lowering speed, leveling speed and stopping speed to insure smooth down-starts and stops. Leveling valve shall be designed to level the car to floor in the direction the car is traveling when slowdown is initiated.

2.12.1.5.6 Manual lowering valve shall be capable of lowering the elevator car in event of power failure. Manual-lowering valve shall be arranged to limit the maximum descending speed under manual operation to 15 fpm.

2.12.1.5.7 A service check-valve shall be installed in oil supply line between power unit and jack.

2.12.1.6 Storage Tank: Storage tank shall be single-wall construction of steel with a steel cover. Manufacturer's recommendation for the type of oil to be used shall be included in written instructions for the care, adjustment and maintenance of equipment.

2.12.1.7 Controller: Electric controller shall be of the microprocessor based logic type with battery backup provided with reduced voltage starting. Components required for proper elevator performance shall be neatly mounted and wired and completely enclosed in a cabinet with a mechanically-latched door. Control cabinet shall be designed for mounting on power unit, wall or floor stand. Electric control apparatus shall be completely isolated from oil reservoir. A feature shall be incorporated in electrical control circuit which will cause elevator car to descent automatically to the lowest terminal landing, if the system runs low on oil during ascending of the car. If power-operated doors are used, the car and hoistway doors shall automatically open when car reaches landing to allow passengers to exit. Parked car shall have doors in closed position and all control buttons shall be made inoperative.

2.12.2 Sound Reduction: Sound-insulating panels shall isolate airborne noise from motor pump assembly. Openings shall be provided to adequately

ventilate the power unit motor. A minimum of two sound-isolating couplings shall be installed in oil line in machine room between pump and jack. Couplings shall be designed and manufactured to be blowout proof. Oil-hydraulic silencer shall be installed in oil line near power unit and shall contain pulsation absorbing material surrounded by a blowout-proof housing. Power unit assembly shall be mounted on vibration pads to isolate the unit from building structure.

2.13 LEVELING DEVICE: Elevators shall be equipped with a 2-way leveling device to automatically bring the car to floor landings. Car shall automatically re-level at each landing to correct the overtravel and undertravel, and maintain the level regardless of load on car. Electric stopping system shall be arranged so that the car will stop level with the floor before brake is set. Stopping accuracy shall not exceed a plus or minus 1/4 inch.

2.14 TWIN JACK UNIT: Provide a twin jack unit for a holeless elevator installation. Jack unit shall be designed and constructed of sufficient size to lift the gross load to the height specified and shall be free from oil leakage. Brittle material such as grey cast iron shall not be used in jack construction. Jack unit shall consist of the following:

2.14.1 Telescoping plunger fabricated of heavy seamless steel tubing accurately turned and polished.

2.14.2 Stop-ring welded or screwed to the plunger to positively prevent plunger from leaving the cylinder.

2.14.3 Internal guide bearing.

2.14.4 Packing or seal.

2.14.5 Drip ring around cylinder top.

2.14.6 Outer cylinder made of steel tubing.

2.24.7 Air bleeder.

2.14.8 Brackets welded to jack cylinder for supporting the elevator on pit channels.

2.14.9 Scavenger pump with copper tubing connected to the tank.

2.15 ELEVATOR SUPPORTS: Structural steel beams, inserts, brackets, bolts and fastening devices shall be provided for proper installation of elevator equipment. Wood plugs are not acceptable.

2.16 BUFFERS: Buffers shall be of design suitable for depth of pit. Buffer anchorage at pit floors shall be provided for each car and counterweight and arranged to avoid puncturing the pit waterproofing. Type of buffer used shall be tested and approved for compliance with elevator service requirements before installation. Pipe struts and steadiers shall be provided as required for pit conditions. A metal plate with information concerning stroke and load-rating shall be permanently fastened to each buffer. Pit-mounted buffers shall have an adequate stroke designed to bring the fully-loaded car and counterweight to rest from governor tripping speed at an average rate of retardation not exceeding gravity. Moving portion of buffer

shall be designed to be accelerated by the car without noticeable peak retardation. Spring buffers shall be in accordance with ASME A17.1.

2.17 LUBRICATION POINTS: Every part subject to movement friction shall be provided with provisions for oil or grease lubrication. All points of lubrication shall be readily accessible.

2.18 SEISMIC REQUIREMENTS: Seismic protection shall be provided to conform to ASME A17.1, Rule XXIV.

PART 3 EXECUTION

3.1 INSTALLATION: Elevators and equipment shall be installed in accordance with ASME A17.1 and manufacturer's recommendation. Guide rails shall be set plumb and parallel and attached to guide rail brackets secured to building structure as required by code. Steel shim plates shall be used for aligning equipment. Guide rail sections shall be joined together in accordance with ASME A17.1. Guide rails shall be thoroughly cleaned and made smooth before elevator is put into operation. During installation all stainless steel shall be protected.

3.2 FIELD WELDING: When structural or load-bearing members are to be field welded, welding and qualification of welders shall be as specified in Section 05055WELDING, STRUCTURAL.

3.3 ELEVATOR WIRING: Wiring shall be provided for electrically-operated items of elevator equipment to comply with requirements of NFPA 70 and Section 16415ELECTRICAL WORK, INTERIOR. For control and signal circuits wire shall be minimum No. 16 AWG. For power and lighting circuits wire shall be minimum No. 12 AWG. Work light fixtures equipped with 150 watt incandescent lamps and ground duplex receptacles shall be provided at top and bottom of car. Work light fixtures and traveling cable junction boxes shall be located to provide illumination at junction boxes. Wiring shall terminate in junction boxes. Wires shall be identified and shall match symbols shown on wiring diagrams. Control and signal wires shall be brought to accessible numbered terminal blocks on the controller. Intra-panel wiring shall be flame-resistant type.

3.3.1 Traveling Cables: Cables shall terminate at numbered terminal blocks in car and machine room. Traveling cable shall be provided with a separate shielded circuit for communication system and hang to obtain proper size of loop. Traveling cable shall be provided with 10 percent spare conductors for each car.

3.4 PAINTING: Except for factory-finished items and corrosion-resistant items, machined surfaces shall be painted as specified in Section 09900 PAINTING, GENERAL.

3.5 TESTING: Testing shall be in accordance with requirements of ASME A17.1 and ASME A17.2.2 and as specified below. The Contractor shall conduct a complete test of the system. After the system has passed all tests, the Contractor shall notify the Contracting Officer in writing, 14 days prior to the time of performing the acceptance test, that the system is complete and is ready for final acceptance testing. The Contractor after receiving written approval from the Contracting Officer will conduct a complete acceptance test of the system. The Contractor shall provide the services of an elevator inspector, employed by an independent testing company to inspect the elevators,

witness the final testing and certify the elevators. The inspector shall meet all qualification requirements of ASME QEI-1 and shall be certified in accordance with ASME QEI-1. The Contractor shall provide an elevator certificate signed by the inspector. The certificate shall be provided to the Contracting Officer within 30 day after the completion of all testing.

3.5.1 Testing Period: Each elevator shall be tested with the specified rated-load in car continuously for a period of 35 percent of the duty time. During the test run the car shall be stopped at all floors in both directions of travel for a standing period of 10 seconds per floor. A manual test of the final limits (UP and DOWN overtravel) shall also be performed.

3.5.2 Speed Load Testing: The actual speed of elevator car in both directions of travel shall be determined with the rated-load and with no-load in the elevator car. Actual measured speed of car with the rated-load in the UP direction shall be within 5 percent of rated speed. The maximum difference in actual measured speeds obtained under the various conditions outlined shall not exceed 10 percent of the total difference between the UP and DOWN speeds.

3.5.3 Car Leveling Testing: Elevator car-leveling devices shall be tested for accuracy of landing at all floors with no-load in car, with symmetrical load in car and with the rated-load in car in both directions of travel.

3.5.4 Temperature Rise Testing: Temperature rise of hydraulic pump motor, motor drive, exciter and booster shall be conducted during the full-load test run for minimum one hour. Under these conditions, temperature rise of equipment shall not exceed the requirements established in NEMA MG 1 Chapter 12. Test shall be started when all parts of equipment are within the temperature required by NEMA at time of starting tests.

3.5.5 Insulation-Resistance Testing: Insulation-resistance testing shall be performed to ensure that the complete elevator wiring systems will be free from short circuits and grounds. Electrical conductors shall have an insulation-resistance of not less than 1 megohm between each conductor and ground, and not less than 1 megohm between each conductor and all other conductors. Prior to testing, provisions shall be made to prevent damage to electronic devices.

3.6 FRAMED INSTRUCTIONS: Two sets of instructions shall be typed and framed under glass or in laminated plastic, and posted side-by-side in the elevator room where directed before acceptance of elevator systems. First set of instructions shall include wiring and control diagrams showing the complete layout of elevator system. Second set of instructions shall include the condensed operating instructions describing preventive maintenance procedures, the methods for checking the elevator system for normal safe operation, and the procedures for safely starting and stopping the elevator system.

DIVISION 15 – MECHANICAL

15250	Thermal Insulation for Domestic and HVAC Piping, Equipment, and Ductwork
15400	Plumbing (with Expanded Part 3—Execution)
15488	Natural Gas Piping (with Expanded Part 3—Execution)
15510	Hydronic Piping
15530	Refrigerant Piping
15550	Heat Generation Equipment (Boilers, Forced Air Furnaces, Duct Furnaces, Unit CA Team Heaters, Radiant Heaters)
15650	Refrigeration Equipment (Compressors, Condensing Units, Chillers, Cooling Towers, Liquid Coolers, Condensers)
15850	Air Handling Equipment (Air Handling Units with Coils, Centrifugal Fans, Axial Fans, Power Ventilators)
15880	Air Distribution Equipment (Air Cleaning Devices, Ductwork, Ductwork Accessories, Air Terminal Units, Air Outlets and Inlets)
15961	Building Preparation for Energy Monitoring and Control System
15971	Direct Digital HVAC Control System
15990	Testing, Adjusting, and Balancing HVAC Systems

DIVISION 15 - MECHANICAL

SECTION 15250

THERMAL INSULATION FOR DOMESTIC AND HVAC PIPING, EQUIPMENT, AND DUCTWORK

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation, replacement and repair of thermal insulation for domestic and HVAC piping, equipment, and ductwork required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this specification to the extent referenced. Publications are referred to by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American Society for Testing and Materials (ASTM) Publications:

A580/A580M	Stainless and Heat Resisting Steel Wire.
A641	Zinc-Coated (Galvanized) Carbon Steel Wire.
B209/B209M	Aluminum and Aluminum-Alloy Sheet and Plate.
C195	Mineral Thermal Insulating and Cement.
C449/C449M	Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
C533	Calcium Silicate Block and Pipe Thermal Insulation.
C534	Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
C547	Mineral Fiber Preformed Pipe Insulation.
C552	Cellular Glass Thermal Insulation.
C553	Mineral Fiber Blanket and Felt Insulation Industrial Type.
C612	Mineral Fiber Block and Board Thermal Insulation.
C647	Properties and Tests of Mastics and Coating Finishes for Thermal Insulation.
C916	Adhesives for Duct Thermal Insulation.
C920	Elastomeric Joint Sealants.
C921	Determining the Properties of Jacketing Materials for Thermal Insulation.
C1071	Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
D3278	Flash Point of Liquids by Setaflash Closed-Cup Apparatus.

E84	Surface Burning Characteristics of Building Materials.
E96	Water Vapor Transmission of Materials.

1.2.2 Federal Specification (FS):

L-P-535	Plastic Sheet (Sheeting): Plastic Strip: Poly(Vinyl Chloride) and Poly (Vinyl Chloride-Vinyl Acetate), Rigid.

1.2.3 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Publication:

SP-69	Pipe Hangers and Supports - Selection and Application.

1.2.4 Midwest Insulation Contractors Association (MICA) Publication:

01	National Commercial and Industrial Insulation Standards.

1.2.5 Military Specifications (MS):

MIL-A-3316	Adhesives, Fire-Resistant, Thermal Insulation.
MIL-C-19565	Coating Compounds, Thermal Insulation, Fire- and Water-Resistant, Vapor-Barrier.
MIL-C-20079	Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass.
MIL-A-24179	Adhesive, Flexible Unicellular-Plastic Thermal Insulation.

1.2.6 National Fire Protection Association (NFPA) Publications:

90A	Installation of Air Conditioning and Ventilating Systems.
90B	Installation of Warm Air Heating and Air Conditioning Systems.
101	Safety to Life from Fire in Buildings and Structures.
251	Fire Tests of Building Construction and Materials.

1.2.7 Underwriters Laboratories (UL) Publication:

723	Test for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in this production of the items, and the most current design which conforms to the requirements specified.

2.1.1 Surface Burning Characteristics: Unless otherwise specified, installed insulation materials, adhesives, coatings, and other accessories shall have flame spread ratings and smoke developed ratings in accordance with NFPA 90A, NFPA 90B, and NFPA 101 for the type occupancy and location that the material is installed unless the location where the material is installed is used as an air plenum, in which case all materials shall have smoke developed ratings not greater than 50 and be non-combustible or limited combustible in accordance with NFPA 90A and NFPA 90B. All insulation shall be tested in the same densities and installed thicknesses as the material that will be used in actual construction applications. Compliance with the smoke developed limitation is not required and a greater flame spread rating up to 100 is permitted for insulation installed within wall assemblies or enclosures with a minimum fire resistance rating of 30 minutes in accordance with NFPA 251, which are not used as supply or return air plenums. Insulation that has been treated with a flame retardant additive to obtain the flame spread and smoke developed ratings shown above are not permitted.

2.1.2 Identification of Materials: Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and all 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.

2.2 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 C795 requirements. Materials shall be asbestos free and conform to the following:

2.2.1 Adhesives:

2.2.1.1 Acoustical Lining Insulation Adhesive: Insulation shall be applied in cut-to-size pieces attached to the interior of ducts with a nonflammable, fire-resistant adhesive which conforms to ASTM C916, Type I, or MS MIL-A-3316, Class 1 or 2; and the requirements of ASTM 84, NFPA 90A, and UL 723. Exposed edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of the nonflammable, fire-resistant adhesive to prevent delamination of glass fibers.

2.2.1.2 Mineral Fiber Insulation Cement: Mineral fiber Insulation cement shall conform to ASTM C195.

2.2.1.3 Contact Adhesive: Contact adhesive shall conform to MS MIL-A-24179, Type II, Class 1 or Type III. Adhesive may be dispersed in a nonhalogenated organic solvent with a low flash point (flash point plus or minus 25 degrees F) or, dispersed in a nonflammable organic solvent which shall not have a fire point below 200 degrees F. 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 door 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 212 degrees F. The adhesive shall be nonflammable, fire resistant conforming to ASTM E84.

2.2.1.4 Lagging Adhesive: Lagging adhesives shall be nonflammable, fire-resistant and conform to MS MIL-A-3316, Class 1 or 2, and the requirements of ASTM E84, NFPA 90A, and UL 723. Class 1 adhesive shall be pigmented [white] [red] 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.

2.2.2 Calking: Calking shall conform to ASTM C920, Type S, Grade NS, Class 25, Use A.

2.2.3 Corner Angles: Corner angles shall be nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall conform to ASTM B209/B209M, Alloy 3003, 3105, or 5005.

2.2.4 Finishing Cement: Mineral fiber hydraulic-setting thermal insulating cement shall conform to ASTM C449.

2.2.5 Glass Tape: Glass tape shall conform to MS MIL-C-20079, Type II, and the requirements of ASTM E84 and UL 723. There shall be no distortion of tape when a sample 24 inches in length is spread across a flat horizontal surface and observed for evidence of distortion (such as tendency to curl rather than lie flat). The width tolerance is plus or minus 0.125 inch.

2.2.5.1 Plain Weave, Untreated: The ends shall be properly interlocked with the picks to ensure that there shall be no raveling of the tape edges. It shall have an average weight of 5.8 plus or minus 10 percent ounces per square yard, an average thickness of 0.007 plus or minus 0.001 inches, warp ends/wales of 42 plus or minus 2 per inch or filling picks/courses of 32 plus or minus 2 per inch, a minimum breaking strength of 150 pounds per inch of width, and after heating to 900 degrees F for 2 hours a minimum breaking strength of 40 pounds per inch of width.

2.2.5.2 Knitted, Untreated: The wales shall be properly interlocked with the courses to ensure that there shall be no raveling of the tape edges. It shall have an average weight of 4.5 plus or minus 10 percent ounces per square yard, an average thickness of 0.007 plus or minus 0.001 inches, warp end/wales of 16 plus or minus 2 per inch, a minimum breaking strength of 40 pounds per inch of width, and after heating to 900 degrees F for 2 hours a minimum breaking strength of 21 pounds per inch of width.

2.2.5.3 Open-Weave Type: Tape shall be open-weave type, and shall have an average weight of 7.0 ounces per square yard and shall be used for embedding between coats of adhesive or coating materials.

2.2.6 Glass Cloth: Glass cloth shall be an untreated light weight satin weave and conform to MS MIL-C-20079, Type I, and the requirements of UL 723. It shall be woven with an eight-harness satin weave and shall be fabricated from fibrous glass yarn. The yarn shall be made from low twist continuous filament glass fiber. The maximum average diameter of the glass fibers used for the yarns shall not exceed 0.000299 inch. The cloth shall have the following properties:

2.2.6.1 Average Weight: 8.9 ounces/square yard.

2.2.6.2 Fabric Count Warp Ends: 57 yarns/inch.

2.2.6.3 Filling Picks: 54 yarns/inch.

2.2.6.4 Minimum Breaking Strength: Warp 200 lb/inch, filling 180 lb/inch, after heating to 900 degrees F for 2 hours - warp 60 lb/inch, filling 60 lb/inch.

2.2.6.5 Width: Nominal width of the cloth shall be 3.333 feet with the following tolerances: Up to and including 40 inches plus or minus 0.5 inch; over 40 inches and less than 60 inches plus or minus 0.75 inch; over 60 inches plus or minus 1 inch.

2.2.6.6 Size of Rolls: The cloth shall be furnished 50 plus or minus 5 yard in rolls, the minimum length in a spliced roll shall be 4 yards and a spliced roll shall contain no more than 3 pieces for each 50 yard length. Open-Weave type of 7.0 ounce/square yard may be used for embedding between coats of adhesive or coating materials.

2.2.7 Staples: Staples shall be outward clinching type manufactured from type 304 or 316 stainless steel conforming to ASTM A167.

2.2.8 Jackets:

2.2.8.1 Cloth Jackets: Cloth jackets shall conform to ASTM C921, Type I or II. Type I is a vapor barrier for use over insulation on pipes, ducts, or equipment operating at temperatures below ambient at least part of the time or wherever a vapor barrier is required. Type II is water vapor permeable and for use over pipes, ducts, or equipment operating above ambient temperatures or wherever a vapor barrier is not required. Type I, moisture vapor transmission maximum 0.02 perms, puncture resistance minimum 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is allowable, tensile strength minimum 35 pounds/inch width; Type II, puncture resistance minimum 25 Beach units, tensile strength minimum 20 pound/inch width.

2.2.8.2 Aluminum Jackets: Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B209/B209M, Temper H14, Temper H16, Alloy 3003, 5005, or 3105 with factory applied moisture barrier. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick, 0.5 inch wide for pipe under 12 inches diameter and 0.75 inch wide for pipe over 12 inches diameter. Aluminum jacket circumferential seam bands shall be 2 by 0.016 inch aluminum matching jacket material. Bands for insulation belowground shall be 0.75 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 Pittsburgh 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.

2.2.8.3 Polyvinyl Chloride (PVC) Jackets: PVC jacket and fitting covers shall be FS L-P-535, Composition A, Type II, with minimum thickness 0.030 inch. Insulation under PVC jacket shall meet jacket manufacturer's written recommendations.

2.2.9 Vapor Barrier Coating: Vapor barrier coating shall be a nonflammable, fire resistant type which conforms to MS MIL-C-19565, Type II, and the requirements of ASTM E84, NFPA 90A, and UL 723. Color shall be white. The wa-

ter vapor permeance of the compound shall not exceed 0.05 perm and shall be determined according to procedure B of ASTM E96 utilizing apparatus described in ASTM E96. The flash point of the compound shall not be less than 80 degrees F and shall be determined in accordance with ASTM D3278. All other application and service properties shall be in accordance with ASTM C647.

2.2.10 Wire: Wire shall be 16 or 18 gauge soft annealed 302, 304 or 316 stainless steel conforming to ASTM A580; or 16 gauge soft annealed galvanized wire conforming to ASTM A641. Galvanized wire shall not be used beneath vapor barriers, in high humidity areas, or on equipment above 600 degrees F.

2.3 PIPE INSULATION MATERIALS: Pipe insulation materials shall be as follows:

2.3.1 Aboveground Cold Pipes: Insulation for aboveground pipes with an operating range between -30 and +60 degrees F shall be as follows:

2.3.1.1 Cellular Glass: Cellular glass insulation shall conform to ASTM C552, Type II (Pipe and Tubing) and/or Type III (Special Shapes) for use on surfaces between -450 and 800 degrees F.

2.3.1.2 Flexible Cellular Insulation: Flexible cellular insulation shall conform to ASTM C534, Type I (Tubular) and/or Type II (Sheet) for use on surfaces between -40 and 200 degrees F.

2.3.1.3 Mineral Fiber: Mineral fiber insulation shall conform to ASTM C547, Class 1 (for use on surfaces up to 450 degrees F) and/or Class 2 (for use on surfaces up to 650 degrees F).

2.3.2 Aboveground Hot Pipes: Insulation for aboveground pipes with an operating range above 60 degrees F shall be as follows:

2.3.2.1 Calcium Silicate: Calcium silicate insulation shall conform to ASTM C533, Type I (for use on surfaces up to 1,200 degrees F), or Type II (for use on surfaces up to 1,600 degrees F).

2.3.2.2 Cellular Glass: Cellular glass insulation shall conform to ASTM C552, Type II (Pipe and Tubing) and/or Type III (Special Shapes) for use on surfaces between -450 and 800 degrees F.

2.3.2.3 Flexible Cellular Insulation: Flexible cellular insulation shall conform to ASTM C534, Type I (Tubular) and/or Type II (Sheet) for use on surfaces between -40 and 200 degrees F.

2.3.2.4 Mineral Fiber: Mineral fiber insulation shall conform to ASTM C547, Class 1 (for use on surfaces up to 450 degrees F) and/or Class 2 (for use on surfaces up to 650 degrees F).

2.3.3 Belowground Cold and Hot Pipes: Insulation for belowground pipes shall be cellular glass conforming to ASTM C552, Type II (Pipe and Tubing) for use on surfaces between -450 and 800 degrees F.

2.4 EQUIPMENT INSULATION MATERIALS: Equipment insulation materials shall be as follows:

2.4.1 Cold Equipment: Insulation for equipment with operating range of 60 degrees F and below.

2.4.1.1 Cellular Glass: Cellular glass insulation shall conform to ASTM C552, Type I (Flat Block), Type III (Special Shapes), and/or Type IV (Board) for use on surfaces between -450 and 800 degrees F.

2.4.1.2 Flexible Cellular Insulation: Flexible cellular insulation shall conform to ASTM C534, Type II (Sheet) for use on surfaces between -40 and 200 degrees F.

2.4.1.3 Flexible Mineral Fiber: Flexible mineral fiber insulation shall conform to ASTM C553, Type I (for use on surfaces up to 450 degrees F).

2.4.1.4 Rigid Mineral Fiber: Rigid mineral fiber insulation shall conform to ASTM C612, Types 1A and 1B (for use on surfaces up to 450 degrees F).

2.4.2 Hot Equipment: Insulation for equipment with operating range above 60 degrees F.

2.4.2.1 Calcium Silicate: Calcium silicate insulation shall conform to ASTM C533, Type I (for use on surfaces up to 1,200 degrees F), or Type II (for use on surfaces up to 1,600 degrees F).

2.4.2.2 Cellular Glass: Cellular glass insulation shall conform to ASTM C552, Type I (Flat Block), Type III (Special Shapes), and/or Type IV (Board) for use on surfaces between -450 and 800 degrees F.

2.4.2.3 Flexible Cellular Insulation: Flexible cellular insulation shall conform to ASTM C534, Type II (Sheet) for use on surfaces between -40 and 200 degrees F.

2.4.2.4 Flexible Mineral Fiber: Flexible mineral fiber insulation shall conform to ASTM C553, Type I (for use on surfaces up to 450 degrees F).

2.4.2.5 Rigid Mineral Fiber: Rigid mineral fiber insulation shall conform to ASTM C612, Types 1A, 1B, II, III, IV, and V (for use on surfaces between 450 and 1,800 degrees F).

2.5 DUCT INSULATION MATERIALS: Cold and warm air duct insulation materials shall be as follows:

2.5.1 Cellular Glass: Cellular glass insulation shall conform to ASTM C552, Type I (Flat Block) for use on surfaces between -450 and 800 degrees F.

2.5.2 Flexible Mineral Fiber: Flexible mineral fiber insulation shall conform to ASTM C553, Type I (for use on surfaces up to 450 degrees F).

2.5.3 Rigid Glass Fiber: Rigid glass fiber duct lining material shall conform to ASTM C1071, Type I (Roll) and/or Type II (Sheet) for use on surfaces up to 250 degrees F.

2.5.4 Rigid Mineral Fiber: Rigid mineral fiber insulation shall conform to ASTM C612, Types 1A and 1B (for use on surfaces up to 450 degrees F).

PART 3 EXECUTION

3.1 GENERAL: Install insulation, vapor barriers and insulation jackets on domestic and HVAC piping, equipment and ductwork as indicated on the plans and specified herein. Unless otherwise indicated, insulation jackets for interior piping systems shall be factory-applied fiberglass reinforced vinyl coated paper and aluminum laminated jackets or fiberglass cloth jackets with integral vapor barriers. PVC fitting covers may be installed as previously specified.

Interior piping so designated on the plans and all exterior piping systems shall have aluminum insulation jackets. Existing insulation, vapor barriers and insulation jackets, on piping not part of this contract, damaged by the Contractor while accomplishing the required work, shall be replaced at no cost to the Government.

3.2 INSTALLATION:

3.2.1 General: Except as otherwise specified, install insulation, vapor barriers and insulation jackets in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until testing 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 may be rejected, and if rejected, shall be immediately removed from the jobsite. Joints shall be staggered on multilayer 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.

3.2.2 Firestopping: Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with firestopping materials as specified in SECTION 07270, FIRESTOPPING.

3.2.3 Painting and Finishing: Painting shall be as specified in SECTION 09920, INTERIOR PAINTING.

3.2.4 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 200 degrees F. 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.

3.2.5 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.

3.3 PIPE INSULATION INSTALLATION:

3.3.1 General:

3.3.1.1 Installation: Pipe insulation shall be continuous and installed on 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:

3.3.1.1.1 Pipe used solely for fire protection.

3.3.1.1.2 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.

3.3.1.1.3 Vertical portions of interior roof drains.

3.3.1.1.4 Sanitary drain lines.

3.3.1.1.5 Unions in pipe with operating range above 60 degrees.

3.3.1.1.6 Strainers in pipe with operating range above 60 degrees.

3.3.1.1.7 Check valves in pipe with operating range above 60 degrees.

3.3.1.1.8 Air chambers.

3.3.1.2 Pipes Passing Through Sleeves:

3.3.1.2.1 Pipe insulation shall be continuous through the sleeve.

3.3.1.2.2 An aluminum jacket with factory applied moisture barrier shall be provided over the insulation wherever penetrations require sealing.

3.3.1.2.3 Where penetrating interior walls, the aluminum jacket shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.

3.3.1.2.4 Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 10 inches above the floor with one band at the floor and one not more than 1 inch from the end of the aluminum jacket.

3.3.1.2.5 Where penetrating waterproofed floors, the aluminum jacket shall extend from below the backup material to a point 2 inches above the flashing with a band 1 inch from the end of the aluminum jacket.

3.3.1.2.6 Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 2 inches beyond the interior surface of the wall.

3.3.1.2.7 Where penetrating roofs, pipe shall be insulated as required for interior service to a point flush with the top of the flashing and sealed with vapor barrier coating. The insulations for exterior application shall butt tightly to the top of flashing and interior insulation. The exterior aluminum jacket shall extend 2 inches down beyond the end of the insulation to form a counter flashing. The flashing and counter flashing shall be sealed underneath with caulking.

3.3.1.3 Pipes Passing Through Hangers:

3.3.1.3.1 Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 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 2 inches shall be installed.

3.3.1.3.2 Horizontal pipes larger than 2 inches with an operating range above 60 degrees F shall be supported on hangers with the addition of a Type 39 saddle in accordance with MSS SP-69.

3.3.1.3.3 Horizontal pipes larger than 2 inches with an operating range of 60 degrees F or less shall 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 2 inches on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 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.

3.3.1.3.4 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 2 inches on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 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 30 feet the weight of the pipe shall be additionally supported 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.

3.3.1.3.5 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 1.5 inches 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 C921, Type 1, and is allowed to be of a different material than the adjoining insulation material.

3.3.1.4 Flexible Cellular Pipe Insulation: Flexible cellular pipe insulation shall be tubular form for pipe sizes 5 inches and less. 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.

3.3.2 Aboveground Cold Pipes: Aboveground pipes with an operating range between -30 Degrees F and +60 Degrees F:

3.3.2.1 Installation: Aboveground cold piping includes the following:

3.3.2.1.1 Domestic cold and chilled drinking water.

3.3.2.1.2 Make-up water.

3.3.2.1.3 Horizontal and vertical portions of interior roof drains.

3.3.2.1.4 Refrigerant suction lines.

3.3.2.1.5 Chilled water.

3.3.2.1.7 Air conditioner condensate drains.

3.3.2.2 Insulation Type and Thickness: Types and thicknesses of insulation shall be as indicated in TABLE I.

TABLE I

Pipe Size in Inches of Pipe Insulation for Pipes With An Operating Range Between -35 Degrees F. to +60 Degrees F. and Domestic Cold Water
CG = Cellular Glass FC = Flexible Cellular MF = Mineral Fiber

Service or Range of Temperature (Degrees F.)	Run-outs* 0.25 to 1.5	Pipe Size, Inches 0.25 to 1.25	1.5 to 3.0	3.5 to 5.0	6.0 to 10.0	11.0 to 24.0	25.0 to 33.0
60 to 35 (CG)		1.5	1.5	2.0	2.0	2.0	2.0
(FC)	0.5	1.0	1.0				
(MF)		1.0	1.0	1.5	1.5	1.5	1.5
34 to 0 (CG)		2.5	2.5	2.5	3.0	3.0	3.5
(MF)		1.5	1.5	2.0	2.0	2.5	2.5
-1 to -30 (CG)		3.0	3.0	3.0	3.5	3.5	4.0
(MF)		1.5	2.0	2.5	2.5	3.0	3.0
Domestic (CG)		1.0	1.0	1.5	1.5	1.5	1.5
Cold Water (FC)		0.5	0.5	0.5	0.5		
& Interior (MF)		0.5	0.5	0.5	1.0	1.0	1.0
Roof Drain Piping (Horizontal Portions Only)							

*When runouts to terminal units exceed 12 feet the entire length of runout shall be insulated like the main feed pipe.

3.3.2.3 Jacket for Fibrous and Cellular Glass Insulated Pipe: Insulation shall be covered with a factory applied vapor barrier jacket or field applied seal welded PVC jacket. Insulation inside the building shown to be protected with an aluminum jacket shall have the insulation and vapor barrier 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.

3.3.2.4 Insulation for Straight Runs (Fibrous and Cellular Glass):

3.3.2.4.1 Insulation shall be applied to the pipe with joints tightly butted. The ends of fibrous insulation shall be sealed off with vapor barrier coating at intervals not to exceed 15 feet.

3.3.2.4.2 Longitudinal laps of the jacket material shall overlap not less than 1.5 inches. Butt strips 3 inches wide shall be provided for circumferential joints.

3.3.2.4.3 Laps and butt strips shall be secured with adhesive and stapled on 4 inches centers if not factory self-sealing.

3.3.2.4.4 Factory self-sealing lap systems may be used when the ambient temperature is between 40 degrees F to 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 manufac-

turer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.

3.3.2.4.5 All Staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor barrier coating. All seams, except those on factory self-seal systems shall be coated with vapor barrier coating.

3.3.2.4.6 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 coated with vapor barrier coating. The patch shall extend not less than 1.5 inches past the break.

3.3.2.4.7 At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor barrier coating.

3.3.2.5 Insulation for Fittings and Accessories:

3.3.2.5.1 Pipe insulation shall have ends thoroughly coated with a vapor barrier coating not more than 6 inches from each flange, union, valve, anchor, or fitting in all directions.

3.3.2.5.2 Insulation may be premolded or segmented. 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 2 inches or one pipe diameter. Loose fill mineral fiber or insulating cement shall be used to fill the voids. Insulation for elbows less than 3 inches size shall be premolded. Insulation for elbows 3 inches size and larger shall be either premolded or segmented. Elbows insulated using segments shall not have less than 3 segments per elbow. Insulation may be secured by wire or tape until finish is applied.

3.3.2.5.3 Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory vapor barrier jackets or PVC fitting covers shall be protected with two coats of vapor barrier coating with a minimum total thickness of 0.0625 inch applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches.

3.3.2.5.4 Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface.

3.3.2.5.5 Flexible connections at pumps and other equipment shall be insulated with 0.5 inch flexible cellular insulation, unless otherwise indicated.

3.3.2.5.6 Insulation shall be marked showing the location of unions, strainers, and check valves.

3.3.2.6 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 barrier 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 barrier coating under the PVC cover. The covers shall be secured by PVC vapor barrier 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 barrier tape to ensure that the assembly has a continuous vapor seal. Factory or fieldcut blanket insulation shall not be used on pipe below 60 degrees F.

3.3.3 Aboveground Hot Pipes: Aboveground pipes with an operating range above 60 Degrees F:

3.3.3.1 Installation: Aboveground hot piping includes the following:

3.3.3.1.1 Domestic hot water.

3.3.3.1.4 Hot water heating.

3.3.3.1.6 Water defrost lines in refrigerated rooms.

3.3.3.2 Insulation Type and Thickness: Insulation thickness shall be determined using the manufacturer's published thermal conductivity k, and the applicable TABLE II or TABLE III. Insulation thickness for piping handling 60 to 200 degrees F domestic hot water shall be as indicated in TABLE IV.

TABLE II

Required Thickness (In Inches) of Pipe Insulation For Piping Handling Fluids Other Than Domestic Hot Water to 250 Degrees F.

k = thermal conductivity (average) Btu/hr. sq. ft. degree/in. thickness at a mean temperature of 75 degrees F.

	Pipe Size, Inches						
Thermal Conductivity k	**2 or Less**	**2.5 to 3.0**	**4.0**	**5.0 to 6.0**	**8.0**	**10.0**	**12.0**
0.25	1.5	1.5	2.0	2.0	2.0	2.0	2.5
0.30	1.5	2.0	2.5	2.5	2.5	2.5	3.0
0.35	2.0	2.5	2.5	2.5	3.5	3.5	3.5
0.40	2.5	3.5	3.5	3.0	4.0	4.0	4.0
0.45	3.0	4.0	4.0	3.5	4.5	4.5	4.5

TABLE IV

Required Thickness (In Inches) of Pipe Insulation For Piping Handling Domestic Hot Water
CG = Cellular Glass FC = Flexible Cellular MF = Mineral Fiber

		Pipe Size, Inches						
Range of Service (Degrees F.)	**Run-outs* 0.25 to 1.5**	**2.0 or Less**	**2.5 to 3.0**	**4.0**	**5.0 to 6.0**	**8.0**	**10.0**	**12.0**
61 to 200 (CG)		1.5	2.5	2.5	2.0	2.0	2.0	2.0
(FC)	0.5	1.0	1.5	1.5	1.5			
(MF)		1.0	1.5	1.5	1.5	1.5	1.5	1.5

*When runouts to terminal units exceed 12 feet the entire length of runout shall be insulated like the main feed pipe.

3.3.3.3 Jacket for Insulated Pipe: Insulation shall be covered with a factory applied Type II jacket or field applied aluminum where required or seal welded PVC.

3.3.3.4 Insulation for Straight Runs:

3.3.3.4.1 Insulation shall be applied to the pipe with joints tightly butted.

3.3.3.4.2 Longitudinal laps of the jacket material shall overlap not less than 1.5 inches and butt strips 3 inches wide shall be provided for circumferential joints.

3.3.3.4.3 Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed.

3.3.3.4.4 Factory self-sealing lap systems may be used when the ambient temperature is between 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.

3.3.3.4.5 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 4 inch centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed. Patch shall extend not less than 1.5 inch past the break.

3.3.3.5 Insulation for Fittings and Accessories:

3.3.3.5.1 The run of the line pipe insulation shall have the ends brought up to the item.

3.3.3.5.2 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 2 inches or one pipe diameter. Loose fill mineral fiber or insulating cement shall be used to fill the voids. Insulation for elbows less than 3 inch size shall be premolded. Insulation for elbows 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.

3.3.3.5.3 Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory vapor barrier 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 1 inch. Adhesive shall extend onto the adjoining insulation not less than 2 inches. The total dry film thickness shall be not less than 0.0625 inch.

3.3.3.5.4 Insulation terminations shall be tapered to unions at a 45-degree angle.

3.3.3.5.5 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

barrier tape, adhesive, seal-welding or with tacks made for securing PVC covers.

3.3.3.6 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.

3.3.3.7 Aluminum Jacket: The jacket for hot piping may be factory applied. The jacket shall overlap not less than 2 inches at longitudinal and circumferential joints and shall be secured with bands at not more than 12 inch centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 60 degrees F and below shall be sealed with caulking while overlapping to prevent moisture penetration. Where jacketing on piping 60 degrees F and below abuts an uninsulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 60 degrees F shall be sealed with a moisture barrier.

3.3.3.8 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 1 inch and the adjoining aluminum jacket not less than 2 inches. 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.

3.3.3.9 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.

3.3.4 Belowground Cold and Hot Pipes: Belowground pipes with an operating range -30 Degrees F and above:

3.3.4.2 Insulation Type and Thickness: Belowground pipe shall be insulated with 3 inch cellular glass insulation set in a coat of bedding compound as recommended by the manufacturer.

3.3.4.3 Insulation for Straight Runs:

3.3.4.3.1 Bore surfaces of the insulation shall be coated with a thin coat of gypsum cement of a type recommended by the insulation manufacturer. Coating thickness shall be sufficient to fill surface cells of insulation. Mastic type materials shall not be permitted for this coating.

3.3.4.3.2 Insulation applied to the pipe shall have joints tightly butted and bedded together with bedding compound as recommended by the manufacturer. Butt joints shall be staggered.

3.3.4.3.3 Stainless steel bands, 0.75 inch wide by 0.020 inch thick shall be used to secure insulation in place. A minimum of two bands per section of insulation shall be applied. As an alternate, fiberglass reinforced tape may be used to secure insulation on piping up to 12 inches in diameter. A minimum of two bands per section of insulation shall be applied.

3.3.4.3.4 Insulation shall terminate at anchor blocks but shall be continuous through sleeves and manholes.

3.3.4.3.5 At point of entry to buildings, underground insulation shall be terminated 2 inches inside the wall or floor, shall butt tightly against the

aboveground insulation and the butt joint shall be sealed with vapor barrier coating.

3.3.4.3.6 Provision for expansion and contraction shall be made in accordance with the insulation manufacturer's recommendations.

3.3.4.4 Insulation for Fittings: Flanges, couplings, valves, and fittings shall be insulated with factory premolded, prefabricated, or field-fabricated sections of insulation of the same material and thickness as the adjoining pipe insulation. Insulation sections shall be secured in place with wire, bore surfaces coated, and joints sealed as specified.

3.3.4.5 Jackets for Insulated Pipe:

3.3.4.5.1 Insulation, including fittings, shall be finished with three coats asphaltic mastic, with 10 by 10 glass mesh reinforcing fabric embedded between coats. Fabric shall be overlapped a minimum of 2 inches at joints. Total film thickness shall be a minimum of 0.1875 inch. As an alternate, a prefabricated bituminous laminated jacket, reinforced with 10 by 10-glass fiber mesh, shall be applied to the insulation. Jacketing material and application procedures shall match manufacturer's written instructions.

3.3.4.5.2 At termination points, other than building entrances, the mastic and cloth or tape shall cover the ends of insulation and extend 2 inches along the bare pipe.

3.4 EQUIPMENT INSULATION INSTALLATION:

3.4.1 General:

3.4.1.1 Installation: 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:

3.4.1.1.1 Handholes.

3.4.1.1.2 Boiler manholes.

3.4.1.1.3 Cleanouts.

3.4.1.1.4 ASME stamps.

3.4.1.1.5 Manufacturer's nameplates.

3.4.2 Cold Equipment: Equipment with an operating range of 60 degrees F and Below.

3.4.2.1 Installation: Insulation shall be installed on the following equipment:

3.4.2.1.1 Pumps.

3.4.2.1.2 Refrigeration equipment parts that are not factory insulated.

3.4.2.1.3 Drip pans under chilled equipment.

3.4.2.1.4 Cold water storage tanks.

3.4.2.1.5 Water softeners.

3.4.2.1.6 Duct mounted coils.

3.4.2.1.7 Cold and chilled water pumps.

3.4.2.1.8 Pneumatic water tanks.

3.4.2.1.9 Roof drain bodies.

3.4.2.1.10 Air handling equipment parts that are not factory insulated.

3.4.2.1.11 Expansion and air separation tanks.

3.4.2.2. Insulation Type and Thickness: Insulation shall be suitable for the operating temperatures and environment encountered. Type and thickness shall be as follows:

3.4.2.2.1 Equipment Handling Media Between 35 and 60 Degrees F: Cellular glass 2 inches thick, flexible cellular 1.5 inches thick, or mineral fiber 1.5 inches thick.

3.4.2.2.2 Equipment Handling Media Between 0 and 34 Degrees F: Cellular glass 3.5 inches thick, flexible cellular 2.5 inches thick, or mineral fiber 2.5 inches thick.

3.4.2.2.3 Equipment Handling Media Between -30 and -1 Degree F: Cellular glass 4 inches thick, flexible cellular 3 inches thick, or mineral fiber 3 inches thick.

3.4.2.3 Pump Insulation:

3.4.2.3.1 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.

3.4.2.3.2 Exposed insulation corners shall be protected with corner angles.

3.4.2.3.3 Upon completion of installation of the insulation, including removable sections, two coats of vapor barrier coating shall be applied with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 0.0625 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.

3.4.2.4 Other Equipment:

3.4.2.4.1 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.

3.4.2.4.2 Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not more than 12 inch centers ex-

cept flexible cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.

3.4.2.4.3 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.

3.4.2.4.4 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 barrier coating with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 0.0625 inch.

3.4.2.4.5 Exposed insulation corners shall be protected with corner angles.

3.4.2.4.6 Insulation on equipment with ribs shall be applied over 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 2 by 2 inches washers or shall be securely banded or wired in place on 12 inch centers.

3.4.2.5 Vapor Barrier: Upon completion of installation of insulation, penetrations shall be caulked. Two coats of vapor barrier 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 0.0625 inch. Caulking shall be applied to parting line between equipment and removable section insulation.

3.4.3 Hot Equipment: Equipment with an operating range of above 60 degrees F.

3.4.3.1 Installation: Insulation shall be installed on the following equipment:

3.4.3.1.4 Water heaters.

3.4.3.1.5 Pumps handling media above 130 degrees F.

3.4.3.1.7 Hot water storage tanks.

3.4.3.1.8 Air separation tanks.

3.4.3.1.13 Boiler flue gas connection from boiler to stack (if inside).

3.4.3.1.14 Induced draft fans.

3.4.3.2 Insulation Type and Thickness: Insulation shall be suitable for the operating temperatures and environment encountered. Shell and tube-type heat exchangers shall be insulated for the temperature of the shell medium. Insulation thicknesses shall be as follows:

3.4.3.2.1 Equipment Handling Media to 250 Degrees F: Cellular glass 3.0 inch thick, or mineral fiber 2.0 inch thick.

3.4.3.2.3 Equipment Handling Media to 600 Degrees F: Cellular glass 7.0 inch thick, or mineral fiber 6.0 inch thick.

3.4.3.3 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 0.0625 inch. Caulking shall be applied to parting line of the removable sections and penetrations.

3.4.3.4 Other Equipment:

3.4.3.4.1 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.

3.4.3.4.2 Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not greater than 12 inch centers except flexible cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.

3.4.3.4.3 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.

3.4.3.4.4 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.

3.4.3.4.5 Exposed insulation corners shall be protected with corner angles.

3.4.3.4.6 On equipment with ribs such as boiler flue gas connection, draft fans, and fly ash or soot collectors, insulation shall be applied over 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 2 by 2 inches washers or shall be securely banded or wired in place on 12 inch (maximum) centers.

3.4.3.4.7 On equipment handling media above 600 degrees F insulation shall be applied in two or more layers with joints staggered.

3.4.3.4.8 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 0.0625 inch. Caulking shall be applied to parting line between equipment and removable section insulation.

3.4.4 Dual Temperature Equipment: Equipment with an operating range of both cold and hot equipment shall be insulated as specified for cold equipment.

3.4.5 Equipment Exposed to Weather:

3.4.5.1 Installation: Equipment exposed to weather shall be insulated and finished in accordance with the requirements for ducts exposed to weather in paragraph DUCT INSULATION INSTALLATION.

3.4.5.2 Optional Panels: At the option of the Contractor, prefabricated metal insulation panels may be used in lieu of the insulation and finish previously specified. Thermal performance shall be equal to or better than that specified for field applied insulation. Panels shall be the standard catalog product of a manufacturer of metal insulation panels. Fastenings, flashing, and support system shall conform to published recommendations of the manufacturer for weatherproof installation that shall prevent moisture from entering the insulation. Panels shall be designed to accommodate thermal expansion and to support a 250 pound walking load without permanent deformation or permanent damage to the insulation. Exterior metal cover sheet shall be aluminum and exposed fastenings shall be stainless steel or aluminum.

3.5 DUCT INSULATION INSTALLATION:

3.5.1 General:

3.5.1.1 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. Duct insulation shall be omitted on the following:

3.5.1.1.1 Factory fabricated double wall internally insulated duct.

3.5.1.1.2 Glass fiber duct.

3.5.1.1.3 Site-erected air conditioning casings and plenums constructed of factory-insulated sheet metal panels.

3.5.1.1.4 Ducts shown to be internally lined with insulation or sound absorbing material, unless indicated otherwise.

3.5.1.1.5 Exposed supply and return ducts in air conditioned spaces unless otherwise shown. Air conditioned spaces shall be defined as those spaces directly supplied with conditioned air, hot or cold, or provided with a cooling or heating device such as a fan-coil unit.

3.5.1.1.6 Return ducts in ceiling spaces [or as indicated]. Ceiling spaces shall be defined as those spaces between the ceiling and bottom of floor deck or roof deck inside the air conditioned space insulated envelope.

3.5.1.1.7 Supply ducts in ceiling spaces which are used as return air plenums [or as indicated]. Ceiling spaces shall be defined as those spaces between the ceiling and bottom of floor deck or roof deck inside the air conditioned space insulated envelope.

3.5.1.1.8 Factory preinsulated flexible ducts.

3.5.1.1.9 Ducts within HVAC equipment.

3.5.1.1.10 Exhaust air ducts unless noted.

3.5.1.1.11 Ceilings which form plenums.

3.5.1.1.12 Duct portions inside walls or floor-ceiling space in which both sides of the space are exposed to conditioned air and the space is not vented or exposed to unconditioned air.

3.5.2 Cold Air Ducts: Ducts with an operating range of 60 degrees F and below:

3.5.2.1 Installation: Ducts and associated equipment shall be insulated including the following:

3.5.2.1.1 Supply ducts.

3.5.2.1.2 Return air ducts.

3.5.2.1.3 Relief ducts.

3.5.2.1.4 Flexible runouts (field-insulated).

3.5.2.1.5 Plenums.

3.5.2.1.6 Duct-mounted coil casings.

3.5.2.1.7 Coil headers and return bends.

3.5.2.1.8 Coil casings.

3.5.2.1.9 Fresh air intake ducts.

3.5.2.1.10 Filter boxes.

3.5.2.1.11 Mixing boxes (field-insulated).

3.5.2.1.12 Supply fans (field-insulated).

3.5.2.1.13 Site-erected air conditioner casings.

3.5.2.1.14 Ducts exposed to weather.

3.5.2.1.15 Combustion are intake ducts.

3.5.2.2 Insulation Type and Thickness: Ducts and associated equipment shall be insulated with cellular glass, glass fiber, or mineral fiber insulation to a thickness of 2 inches except relief ducts and fresh air intake ducts which shall be 1.5 inches. Insulation for rectangular ducts shall be flexible type where concealed, minimum density 0.75 pcf and rigid type where exposed, minimum density 3.0 pcf. Insulation for round ducts shall be flexible type, minimum density 0.75 pcf with a factory Type I jacket. Fibrous and cellular glass insulation for exposed ducts shall be provided with either a white, paintable, factory-applied Type I jacket or a vapor barrier jacket coating finish as specified. Fibrous and cellular glass insulation on concealed duct shall be provided with a factory-applied Type I vapor barrier jacket. Vapor barrier coating finish where indicated to be used shall be accomplished by applying two coats of vapor barrier coating with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 0.0625 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 barrier shall cover the collar, neck, and any uninsulated surfaces of diffusers, registers and grilles. Vapor barrier materials shall be applied to form a complete unbroken vapor seal over the insulation.

3.5.2.3 Installation on Concealed Ducts:

3.5.2.3.1 For rectangular, oval or round ducts, insulation shall be attached by applying Class 2 adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

3.5.2.3.2 For rectangular and oval ducts, 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corners.

3.5.2.3.3 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 18 inch centers and not more than 18 inches from duct corners.

3.5.2.3.4 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 barrier jacket joints overlap 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hanger.

3.5.2.3.5 Self-locking washers shall be installed where mechanical fasteners are used. The pin shall be trimmed back and bent over.

3.5.2.3.6 Jacket overlaps shall be secured under the overlap with Class 2 adhesive and stapled on 4 inch centers. Staples and seams shall be coated with a brush coat of vapor barrier coating.

3.5.2.3.7 Breaks in the jacket material shall be covered with patches of the same material as the vapor barrier. The patches shall extend not less than 2 inches 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 barrier coating.

3.5.2.3.8 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 barrier coating.

3.5.2.3.9 Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor barrier coating finish. The coating shall overlap the adjoining insulation and uninsulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

3.5.2.3.10 Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

3.5.2.4 Installation on Exposed Ducts:

3.5.2.4.1 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 12 inches apart and not more than 3 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger. One row shall be provided for each side of duct less than 12 inches.

3.5.2.4.2 Duct insulation shall be formed with minimum jacket seams. Each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. Insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over. Vapor barrier 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.

3.5.2.4.3 Insulation shall be impaled on the fasteners; self-locking washers shall be installed and the pin trimmed and bent over.

3.5.2.4.4 Joints in the insulation jacket shall be sealed with a 4 inches wide strip of the same material as the vapor barrier jacket. The strip shall be secured with Class 2 adhesive and stapled. Staples and seams shall be sealed with a brush coat of vapor barrier coating.

3.5.2.4.5 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 2 inches 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 barrier coating.

3.5.2.4.6 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 barrier coating.

3.5.2.4.7 Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor barrier coating finish. The coating shall overlap the adjoining insulation and uninsulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

3.5.2.4.8 Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation with minimum density of 0.75 pcf attached by applying Class 2 adhesive around the entire perimeter of the duct in 6 inch wide stripe on 12 inch centers.

3.5.3 Warm Air Ducts: Ducts with an operating range above 60 degrees F.

3.5.3.1 Installation: Warm air ducts and associated equipment shall be insulated including the following:

3.5.3.1.1 Supply ducts.

3.5.3.1.2 Return air ducts.

3.5.3.1.3 Relief air ducts.

3.5.3.1.4 Flexible runouts (field insulated).

3.5.3.1.5 Plenums.

3.5.3.1.6 Duct-mounted coil casings.

3.5.3.1.7 Coil-headers and return bends.

3.5.3.1.8 Coil casings.

3.5.3.1.9 Fresh air intake ducts.

3.5.3.1.10 Filter boxes.

3.5.3.1.11 Mixing boxes.

3.5.3.1.12 Supply fans.

3.5.3.1.13 Site-erected air conditioner casings.

3.5.3.2 Insulation Type and Thickness: Ducts and associated equipment shall be insulated with cellular glass, glass fiber, or mineral fiber insulation to a thickness of 2 inches except relief ducts and fresh air intake ducts which shall be 1.5 inches. Insulation for rectangular ducts shall be flexible type where concealed, minimum density 0.75 pcf, and rigid type where exposed, minimum density 3.0 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 0.75 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 0.0625 inch. Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.5.3.3 Installation on Concealed Ducts:

3.5.3.3.1 For rectangular, oval and round ducts, insulation shall be attached by applying Class 2 adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

3.5.3.3.2 For rectangular and oval ducts 24 inches and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18 inches centers and not more than 18 inches from duct corner.

3.5.3.3.3 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 18 inch centers and not more than 18 inches from duct corners.

3.5.3.3.4 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.

3.5.3.3.5 Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.

3.5.3.3.6. Insulation jacket shall overlap not less than 2 inches at joints and the lap shall be secured with Class 2 adhesive under the lap and stapled on 4 inch centers.

3.5.3.4 Installation on Exposed Ducts:

3.5.3.4.1 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 12 inches apart and not more than 3 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger and a minimum of one row for each side of duct less than 12 inches.

3.5.3.4.2 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. 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, reinforc-

ing, and projections. Where height of projections is greater than the insulation thickness, insulation and jacket shall be carried over the projection.

3.5.3.4.3 Insulation shall be impaled on the fasteners; self-locking washers shall be installed and pin excess clipped and bent over.

3.5.3.4.4 Joints on jacketed insulation shall be sealed with a 4 inch wide strip of the same material as the jacket. The strip shall be secured with Class 2 adhesive and stapled.

3.5.3.4.5 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 2 inches beyond the break or penetration and shall be secured with Class 2 adhesive and stapled.

3.5.3.4.6 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 0.0625 and shall overlap the adjoining insulation and uninsulated surface 2 inches.

3.5.3.4.7 Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation, minimum density of 0.75 pcf attached by applying Class 2 adhesive around the entire perimeter of the duct in 6 inch wide stripe on 12 inch center. Joints shall be sealed with a 4 inch wide strip of the same material as the jacket. The strip shall be secured with Class 2 adhesive and stapled.

3.5.4 Dual Temperature Air Ducts: Ducts with an operating range of both cold and warm air ducts shall be insulated as specified for cold air duct.

3.5.5 Evaporative Cooling Ducts: Evaporative cooling supply duct located in spaces not evaporatively cooled, shall be insulated. Material and installation requirements shall be as specified for duct insulation for warm air duct.

3.5.6 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.

3.5.7.2 Round Ducts: Aluminum jacket with factory applied moisture barrier shall be applied with the joints lapped not less than 3 inches and secured with bands located at circumferential laps and at not more than 12 inch intervals throughout. Horizontal joints shall lap down to shed water and located at 4 or 8 o'clock position. Joints shall be sealed with caulking to prevent moisture penetration. Where jacketing abuts an uninsulated surface, joints shall be sealed with caulking.

3.5.7.3 Fittings: Fittings and other irregular shapes shall be finished as specified for rectangular ducts.

3.5.7.4 Rectangular Ducts: Two coats of weatherproof mastic shall be applied to the entire surface with a layer of glass cloth embedded between coats. Glass cloth overlaps at joints and adjoining surfaces shall be not less than 2 inches. Each coat of weatherproof mastic shall be 0.0625 inch minimum thickness. The top of the exterior duct work shall be built up with insulation in such a manner as to ensure a positive drain of any rain water which may appear. The minimum pitch of the built up section shall be in accordance with the recommendation of the manufacturer of the vapor barrier/weatherproof mastic. Care should be taken in the construction of the built up section so that

no low areas appear; this shall ensure no "pooling" of water on the vapor barrier which leads to premature degradation of the barrier and subsequent deterioration of the insulation.

DIVISION 15 - MECHANICAL

SECTION 15400

PLUMBING

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the accomplishment of plumbing work required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standards:

A112.1.2	Air Gaps in Plumbing Systems.
A112.6.1M	Supports for Off-The-Floor Plumbing Fixtures for Public Use.
A112.18.1M	Finished and Rough Brass Plumbing Fixture Fittings.
A112.19.1M	Enameled Cast Iron Plumbing Fixtures.
A112.19.2M	Vitreous China Plumbing Fixtures.
A112.19.3	Stainless Steel Plumbing Fixtures
A112.19.4M	Porcelain Enameled Formed Steel Plumbing Fixtures.
A112.19.5	Trim for Water-Closet Bowls, Tanks, and Urinals.
A112.21.1M	Floor Drains.
A112.21.3M	Hydrants for Utility and Maintenance Use.
A112.26.1M	Water Hammer Arresters.
A112.36.2M	Cleanouts.
A117.1	American National Standard For Buildings and Facilities Providing Accessibility and Usability For Physically Handicapped People.
A161.1	Minimum Construction and Performance Standards for Kitchen and Vanity Cabinets.
B1.20.1	Pipe Threads, General Purpose (Inch).
B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 300.
B16.3	Malleable Iron Threaded Fittings.
B16.12	Cast-Iron Threaded Drainage Fittings.
B16.18	Cast Copper Alloy Solder Joint Pressure Fittings.

B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
B16.23	Cast Copper Alloy Solder Joint Drainage Fittings-DWV.
B16.29	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings-DWV.
B16.39	Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300.
CDS-1	Controls and Safety Devices for Automatically Fired Boilers.
Z21.10.1	Gas Water Heaters Volume I Storage Water Heaters with Inputs of 75,000 BTU Per Hour or Less.
Z21.10.3	Gas Water Heaters Volume III Storage Input Ratings Above 75,000 BTU per hour, Circulating and Instantaneous Water Heaters.
Z21.22	Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.
Z97.1	Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings.

1.2.2 Air Conditioning and Refrigeration Institute (ARI) Standard:

1010	Drinking-Fountains and Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers.

1.2.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Publication:

90A	Energy Conservation in New Building Design.

1.2.4 American Society of Mechanical Engineers (ASME) Publications:

16	Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels, Division 1 - Basic Coverage.
17	Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications.

1.2.5 American Society of Sanitary Engineering (ASSE) Standards:

1003	Water Pressure Reducing Valves for Domestic Water Supply Systems.
1005	Water Heater Drain Valves 3/4 Inch Iron Pipe Size.
1019	Wall Hydrants, Frost-Proof Automatic Draining, Anti-Backflow Types.
1037	Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures.

1.2.6 American Society for Testing and Materials (ASTM) Publications:

A53/A53M	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
A74	Cast Iron Soil Pipe Fittings.
A733	Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples.
B32	Solder Metal.
B88	Seamless Copper Water Tube.
B306	Copper Drainage Tube (DWV).
B641	Seamless and Welded Copper Distribution Tube (Type D).
C564	Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
D2661	Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe.
D2662	Polybutylene (PB) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
D2665	Polyvinyl Chloride (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
D2751	Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
D2846	Chlorinated Polyvinyl Chloride (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
D3000	Polybutylene (PB) Plastic Pipe (SDR-PR) Based on Outside Diameter.
D3139	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
D3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
D3309	Polybutylene (PB) Plastic Hot- and Cold-Water Distribution Systems.
F437	Threaded Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80.
F438	Socket-Type Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40.
F439	Socket-Type Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80.
F441	Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe, Schedules 40 and 80.
F442	Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe (SDR-PR).

1.2.7 American Water Works Association (AWWA) Publication:

C606	Grooved and Shouldered Joints.

1.2.8 Cast Iron Soil Pipe Institute (CISPI) Publications:

301	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
HSN	Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings.

1.2.9 Copper Development Association (CDA) Publication:

1.0	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube.

1.2.10 Federal Specifications (FS):

W-H-196	Heater, Water, Electric, and Gas-fired, Residential.
A-A-238	Seat, Water Closet.
WW-U-516	Unions, Brass or Bronze, Threaded Pipe Connections, and Solder-Joint Tube Connections.
WW-P-521	Pipe Fittings, Flange Fittings, and Flanges: Steel and Malleable Iron (Threaded and Butt Welding) Class 150.
WW-U-531	Unions, Pipe, Steel or Malleable Iron; Threaded Connection, 150 Lb, 250 LB, and 300 LB WSP.
WW-P-541	Plumbing Fixtures (General Specification).
WW-P-541/1	Plumbing Fixtures (Water Closets) (Detail Specification).
WW-P-541/2	Plumbing Fixtures (Urinals) (Detail Specification).
WW-P-541/4	Plumbing Fixtures (Lavatories) (Detail Specification).
WW-P-541/5	Plumbing Fixtures (Sinks, Kitchen, Service, and Laundry Trays) (Detail Specification).
WW-P-541/6	Plumbing Fixtures (Drinking Fountains) (Detail Specification).
QQ-B-654	Brazing Alloys, Silver.
WW-F-1910	Faucet; Double, Single, and Lawn (Laundry Sink, Kitchen, and Lavatory) (Land Use).

1.2.11 Hydraulic Institute (HI) Publication:

01	Centrifugal, Rotary, and Reciprocating Pumps.

1.2.12 International Association of Plumbing and Mechanical Officials (IAPMO) Publication:

Uniform Plumbing Code (UPC).

1.2.13 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Standards:

SP 58	Pipe Hangers and Supports - Materials, Design and Manufacture.
SP 67	Butterfly Valves.
SP 69	Pipe Hangers and Supports - Selection and Application.
SP 70	Cast Iron Gate Valves, Flanged and Threaded Ends.
SP 71	Cast Iron Swing Check Valves, Flanged and Threaded Ends.
SP 72	Ball Valves with Flanged or Butt-Welding Ends for General Service.
SP 73	Brazing Joints for Copper and Copper Alloy Pressure Fittings.
SP 78	Cast Iron Plug Valves, Flanged and Threaded Ends.
SP 80	Bronze Gate, Globe, Angle and Check Valves.
SP 83	Steel Pipe Unions Socket-Welding and Threaded.
SP 84	Steel Valves - Socket Welding and Threaded Ends.
SP 85	Cast Iron Globe and Angle Valves Flanged and Threaded Ends.
SP 89	Pipe Hangers and Supports - Fabrication and Installation Practices.

1.2.14 Military Specifications (MS):

MIL-T-12295	Tanks, Hot Water Storage.
MIL-T-27730	Tape, Antiseize, Polytetrafluoroethylene, with Dispenser.

1.2.15 National Association of Plumbing-Heating-Cooling Contractors (NAPHCC) Publication:

01	National Standard Plumbing Code (NSPC).

1.2.16 National Electrical Manufacturers Association (NEMA) Publication:

250	Enclosures for Electrical Equipment (1000 Volts Maximum).

1.2.17 National Fire Protection Association (NFPA) Standards:

54 National Fuel Gas Code (NFGC).

70 National Electrical Code (NEC).

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: Submit color and pattern samples for selection of finish for vanity cabinets and color and pattern for vanity tops.

1.3.3 Installation, Operation, and Maintenance Instructions: Submit manufacturer's written installation, operation, and maintenance instructions.

1.3.4 Shop Drawings: Submit shop drawings showing the proposed installation of plumbing system and fixtures.

1.3.5 As-Built Drawings: Submit as-built drawings for all work performed under this section.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 CLEANOUTS: Cleanouts shall conform to ANSI/ASME A112.36.2M.

2.3 DISHWASHERS: Refer to SECTION 11450, APPLIANCES.

2.4 DOMESTIC WATER DISTRIBUTION AND SERVICE LINES: Refer to SECTION 02666, DOMESTIC WATER DISTRIBUTION AND SERVICE PIPING.

2.5 DRINKING FOUNTAINS:

2.5.1 Indoor Drinking Fountains: Indoor drinking fountains shall conform to ARI 1010, FS WW-P-541, and WW-P-541/6, SPN: A0213(b). Drinking fountains shall be wall-mounted, mechanically chilled, and have a capacity of 8.0 gph of 50 degrees F. water based on 80 degrees F. inlet water and 90 degrees F. ambient air. Drinking fountains shall be 120 volts, 60 hertz AC.

2.6 ESCUTCHEONS: Escutcheons shall be corrosion-resisting chrome plated or polished metal.

2.7 EXPANSION TANKS: The domestic 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 scheduled on the drawings. The expansion tank shall be welded steel, constructed, tested, and stamped in accordance with ASME 16 for a working pressure of 125 psi and factory-precharged to the minimum operating pressure of 30 psig. The tank's air chamber shall be fitted with an air charging valve and pressure gage. The tank’s diaphragm shall be constructed of heavy duty butyl material. The tank shall be supported by steel saddles for vertical installations. The tank shall have lifting rings and a drain

connection. All components shall be suitable for a maximum operating temperature of 240 degrees F.

2.8 FAUCETS: Faucets shall conform to ANSI/ASME A112.18.1M and FS WW-F-1910. Residential single control faucets shall have an all-brass body and a single control to turn the water on and off and to regulate the volume and temperature of the flow. The faucet shall be designed so that the valve body has no wearing parts and all operating parts shall be easily renewed without disconnecting the faucet from the fixture on which it is mounted or disconnecting the water supply lines. It shall have a water conservation device to control the volume flow to no more than 2.5 gpm regardless of water pressure. The faucet should be of a cartridge type design constructed so that all operating parts subject to wear are within the cartridge and are replaced as a single unit. The cartridge shall be interchangeable with any other single-control faucets used from the same manufacturer. The cartridge should be so designed to take advantage of any back-to-back installations and allow a change in the polarity of the water without having to remove the cartridge or disconnect any water supply lines. Commercial faucets shall be single control with washerless ceramic valving or double handle with non-rotating rubber seals and renewable seats as indicated.

2.9 FLOOR DRAINS: Floor drains shall conform to ANSI/ASME A112.21.1.

2.9.1 Floor Drains: Cast iron body and flashing collar with nickel bronze adjustable strainer head, and 2 inch outlet. Floor drains for installation in floors not having membrane waterproofing may have seepage flange without clamping device. Floor drains shall be designed for general service, Jay R. Smith, 2005-A series, or an approved equal.

2.9.2 Floor Drains: Cast iron body, cast iron grate, sediment bucket, and 2 inch outlet. Design shall ensure bucket replacement after cleaning by requiring top grate installation only with bucket in place. Floor drains shall be designed for general medium duty service, Jay R. Smith, 2210 series, or an approved equal.

2.10 HANGERS AND SUPPORTS: Pipe hangers and supports shall conform to MSS SP 58, SP 69 and SP 89, and be of such materials and design as to rigidly secure piping without causing damage to the piping, fittings, or insulation.

2.11 HOT WATER STORAGE TANKS: Hot water storage tanks shall be constructed by one manufacturer, ANSI stamped for the working pressure, and shall have the National Board (ANSI) registration. The standby heat loss shall comply with the requirements of ASHRAE 90A. Hot water storage tanks shall conform to MS MIL-T-12295, Type II, cement-lined steel. Each tank shall be equipped with a thermometer style and form as required for the installation, and with 7 inch scale. Thermometer shall have a separable socket suitable for a 0.75 inch tapped opening. Insulation shall be as specified in SECTION 15250, THERMAL INSULATION FOR DOMESTIC AND HVAC PIPING, EQUIPMENT, AND DUCTWORK.

2.12 P-TRAPS: Exposed P-traps shall be chrome-plated brass. Unexposed P-traps may be approved material compatible with DWV piping.

2.13 PIPE AND FITTINGS:

2.13.1 ABS Drain, Waste, and Vent (DWV) Pipe and Fittings: ABS DWV pipe and fittings shall conform to ASTM D2661.

2.13.2 ABS Sewer Pipe And Fittings: ABS sewer pipe and fittings shall conform to ASTM D2751.

2.13.3 Cast Iron Drain, Waste, and Vent (DWV) Pipe and Fittings: Cast iron DWV pipe shall conform to ASTM A74 and CISPI 301. Cast iron DWV fittings shall conform to ANSI B16.12 and CISPI 301.

2.13.4 Copper Drain, Waste, and Vent (DWV) Tube and Fittings: Copper DWV tube shall conform to ASTM B306. Copper DWV fittings shall conform to ANSI B16.23 and ANSI B16.29.

2.13.5 Copper Water Tube and Fittings: Copper water tube shall conform to ASTM B88, Type L or K; or ASTM B641, Type D. Copper water tube fittings shall conform to ANSI B16.18 or ANSI B16.22.

2.13.6 CPVC Water Pipe And Fittings: CPVC water pipe shall conform to ASTM D2846, ASTM F441, or ASTM F442. CPVC pipe fittings shall conform to ASTM F437, ASTM F438, or ASTM F439 as appropriate for the application.

2.13.7 Pipe Nipples: Pipe nipples shall conform to ASTM A733.

2.13.8 Pipe Threads: Pipe threads shall conform to ANSI B1.20.1.

2.13.9 Polybutylene Water Pipe and Fittings: Polybutylene pipe shall conform to ASTM D2662, PB2110, SIDR 11.5; ASTM D3000; or ASTM D3309, PB 2110, SDR 11. Fittings for polybutylene piping systems shall conform to ASTM D3309.

2.13.10 PVC Drain, Waste, and Vent (DWV) Pipe and Fittings: PVC DWV pipe and fittings shall conform to ASTM D2665.

2.13.11 Steel Pipe and Fittings: Black and galvanized steel pipe shall conform to ASTM A53, Type S, Grade B, Standard Weight, Schedule 40. Black and galvanized steel pipe fittings shall conform to ANSI B16.1, ANSI B16.3, or FS WW-P-521 as appropriate for the application.

2.13.12 Unions: Unions shall conform to ANSI B16.39, FS WW-U-516, FS WW-U-531, or MSS SP 83 as appropriate for the application.

2.14 PIPE JOINT MATERIALS: Joints and gaskets materials shall conform to the following:

2.14.1 Brazing Alloy: Silver brazing alloy shall conform to FS QQ-B-654, Classification BCuP-5. Silver brazing alloy shall be used for all below ground solder joint fitting connections. Brazing shall conform to MSS SP 73.

2.14.2 Couplings for Cast Iron Pipe: Couplings for cast iron pipe shall conform to ASTM A74 and/or AWWA C606.

2.14.3 Flexible Elastomeric Seals: Flexible elastomeric seals shall conform to ASTM D3139 and/or ASTM D3212.

2.14.4 Neoprene Gaskets for Hub and Cast Iron Pipe and Fittings Neoprene gaskets for hub and cast iron pipe and fittings shall conform to CISPI Std HSN.

2.14.5 Rubber Gaskets for Cast Iron Soil Pipe and Fittings: Rubber gaskets for cast iron soil pipe and fittings shall conform to ASTM C564.

2.14.6 Sealants for Metallic Pipe Threaded Joints:

2.14.6.1 Antiseizing Tape: Tetrafluoroethylene tape shall conform to MS MIL-T-27730.

2.14.6.2 Sealing Compound: Joint sealing compound shall be as listed in the UL Gas and Oil Equipment Directory, Class 20 or less.

2.14.7 Solder Flux: Solder Flux shall be liquid form, non-corrosive, and conform to CDA 1.0, Standard Test 1.

2.14.8 Solder Material: Solder metal shall conform to ASTM B32, 95-5 tin-antimony.

2.15 PUMPS:

2.15.1 Circulating Pumps: Circulating pumps shall conform to HI 01. 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 close-coupled with an overhung impeller. The shaft shall be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze. Motor shall have sufficient horsepower for the service required. Each pump motor shall be provided with across-the-line type, magnetic controller complete in a NEMA 250, Type 1 enclosure with "START-STOP" switch in cover. Fractional horsepower pump motors shall have integral thermal overload protection in accordance with SECTION 16050, ELECTRICAL. Guards shall shield exposed moving parts.

2.15.2 Submersible Sump Pumps: Sump pumps shall conform to HI 01 and be the capacities indicated. The pumps shall be of the automatic, electric motor-driven, submerged type, complete with necessary control equipment and with a solid cast-iron or steel cover plate. Motors shall be totally enclosed of sizes as indicated and each shall be equipped with NEMA 250, Type 4 enclosed, across-the-line, magnetic controller. The suction inlet shall be between 3 and 6 inches above the sump bottom. The suction side of each pump shall have a strainer of ample capacity. A float switch, completely enclosed in a NEMA 250, Type 4 enclosure, shall start and stop each motor at predetermined water levels. 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.

2.16 SERVICE SINKS: Service sinks shall conform to ANSI/ASME A112.19.1M, FS WW-P-541, and FS WW-P-541/5, SPN: 100. Service sinks shall be white enameled cast iron, rolled rim on trap standard, 24 by 24 inches, and have removable strainer and 8-inch faucet centers. Service sinks shall be installed with the faucets and wall supports specified.

2.17 SILL COCKS: Sill cocks shall conform to ANSI/ASME A112.18.1M, ASSE 1019, and FS A-A-232. Sill cocks shall be chrome plated brass or malleable iron, freeze proof, automatic draining, anti-backflow type, and have .075 inch MIP threaded hose connection.

2.18 STOPS AND SUPPLY CONNECTIONS: Stops and supply connections shall be chrome plated brass.

2.19 SUPPORTS: Supports for off-the-floor plumbing fixtures shall conform to ANSI/ASME A112.6.1M.

2.20 TRIM: Trim for water-closet bowls, tanks, and urinals shall conform to ANSI/ASME A112.19.5, ASSE 1037, and FS A-A-238. Water closet flush valves shall be Sloan Royal Model No. 111, or an approved equal. Urinal flush valves shall be Sloan Royal Model No. 186-1, or an approved equal.

2.21 URINALS: Urinals shall conform to ANSI/ASME A112.19.2M, FS WW-P-541, and FS WW-P-541/2, SPN: WHW0003. Urinals shall be white vitreous china, wall-hung washout type with extended shields. Urinals shall be installed with the trim and wall supports specified.

2.22 VALVES: Valves shall be provided on supplies to equipment and fixtures. Valves 2.5 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 3.0 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Valves used for water service shall have the zinc content limited to no more than 6 percent for the stem, body, bonnet, wedge, or disk in contact with the fluid. Valves shall be the type and material indicated on the plans.

Description of Valve	**Standard**
Backwater Valves	ANSI/ASME A112.14.1
Ball Valves, Flanged and Butt-Welding Ends for General Service	MSS SP 72
Butterfly Valves	MSS SP 67
Bronze Gate, Globe, Angle, and Check Valves	MSS SP 80
Cast Iron Gate Valves, Flanged and Threaded Ends	MSS SP 70
Cast Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP 85
Cast Iron Plug Valves, Flanged and Threaded Ends	MSS SP 78
Cast Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP 71
Pressure Reducing Valves	ASSE 1003
Steel Valves, Socket Welding and Threaded Ends	MSS SP 84
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22
Temperature and Pressure Safety Relief Valves for Automatically Fired Hot Water Boilers	ANSI CSD-1
Water Heater Drain Valves	ASSE 1005

2.23 WATER CLOSETS:

2.23.1 Wall-Mounted Commercial Water Closets: Wall-mounted commercial water closets shall conform to ANSI/ASME A112.19.2M, FS WW-P-541, and FS WW-P-541/1, SPN: SJEB225 (Elongated Bowl). Water closets shall be white vitreous china, siphon-jet, elongated bowl, standard height, with wall outlet and top supply spud. Water closets shall be installed with the trim and wall supports specified.

2.24 WATER HAMMER ARRESTERS: Water hammer arresters shall conform to ANSI/ASME A112.26.1.

2.25 WATER HEATERS: Gas-fired water heaters with an input of 75,000 Btuh or less shall conform to ANSI Z21.10.1 and FS W-H-196. Gas-fired water heaters

over 75,000 Btuh input shall conform to ANSI Z21.10.3 and FS W-H-196. Gas-fired water heaters shall be supplied with draft hoods, flues and roof caps as necessary to make complete installations. Electric water heaters shall conform to FS W-H-196 and UL 174. All water heaters shall be supplied with pressure temperature relief valves conforming to ANSI Z21.22.

2.25.1 Relief Valves: Water heaters and hot water storage tanks shall have combination pressure and temperature (P and T) relief valves. The pressure relief element of a P and T relief valve must 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 and 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 200,000 BTUH shall have 0.75 inch minimum inlets, and 0.75 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 BTUH shall have 1 inch minimum inlets, and 1 inch outlets. A vacuum relief valve shall be installed on the cold water supply line to the water heater or hot water storage tank. The discharge pipe from the relief valve shall be the size of the valve outlet.

PART 3 EXECUTION

3.1 GENERAL: Perform all plumbing work indicated on the plans and specified herein. Replacement of plumbing components may require the Contractor to modify water supply and DWV piping because the replacement component is different from the original component. For example, replacement of a wall hung lavatory with a vanity cabinet and cultured marble vanity top.

3.2 INSTALLATION: Accomplish all plumbing work in accordance with the UPC, NAPHCC 01, approved shop drawings, and any applicable manufacturer's written installation instructions. Installation and replacement of plumbing components includes replacement of incidental plumbing fittings and piping and electrical devices and wiring necessary to make complete installations free from defects and code violations. When drumtraps are encountered during bathtub replacement, they shall be removed and replaced with P-traps. The Contractor is responsible for shutting off and turning on building water supplies as necessary to accomplish the work regardless of supply valve locations.

3.2.1 Electrical: Electrical supply connections shall conform to NFPA 70.

3.2.2 Gas Piping: Gas supply piping and connections shall conform to NFPA 54.

3.2.3 Domestic Water Pipe, Fittings and Connections:

3.2.3.1 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.

3.2.3.2 Protection to 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.

3.2.3.3 Mains, Branches, and Runouts: Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Care shall be taken not to weaken structural portions of the building. 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 will be kept a sufficient distance from other work and other services to permit not less than 0.5 inch 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. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted. Change in direction shall be made with fittings.

3.2.3.4 Pipe Drains: Pipe drains indicated shall consist of 0.75 inch hose bibb with renewable seat and gate valve or ball valve ahead of hose bibb. At other low points, 0.75 inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.2.4 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.

3.2.4.1 Copper Tube and Pipe: Joints shall use fittings made for the purpose, have clearances of 0.001 to 0.003 inch, be brazed, and be made with flux. Tubes shall be cut square and reamed to remove burrs. The outside surface of the tube to contact the fitting and inside surface of the fitting shall be cleaned with an abrasive material just prior to making connections. Care shall be taken to prevent annealing of the tube or fittings when making connections. Connections of 2.5 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multiflame torch.

3.2.4.1.1 Brazed: Brazed joints shall be made in conformance with MSS SP-73, with flux and are acceptable for all line sizes. Excess flux and brazing material shall be wiped off the line and fitting exterior before it dries and hardens. Excess flux or brazing material on the inside surface of the tube or fitting shall be avoided.

3.2.4.1.2 Soldered: Soldered joints shall be made with flux and are only acceptable for lines 2.0 inches and smaller. Joints shall be heated to 850 degrees F before the solder is applied.

3.2.4.2 Threaded: Threaded joints shall have American Standard taper pipe threads conforming to ANSI 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.

3.2.4.3 Union and Flanged: Unions and flanges shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2.5 inches and smaller; flanges shall be used on pipe sizes 3.0 inches and larger.

3.2.5 Drain, Waste and Vent Piping: No joint shall be located within 6 inches of any floor.

3.2.6 Dissimilar Pipe Materials: Connections between ferrous and copper pipe shall be made with dielectric unions or flanges. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.2.7 Supports: Hangers used to support piping 2.0 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. All 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.

3.2.8 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. 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 for acid-resisting waste shall be of the same material as the pipe.

3.2.9 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.

3.2.10 Water Heaters and Hot Water Storage Tanks:

3.2.10.1 Relief Valves: No valves shall be installed between a relief valve and its water heater or storage tank. The P and 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 and T valve shall be installed in the hot-water outlet piping.

3.2.10.2 Installation of Gas-Fired Water Heater: Installation shall conform to NFPA 54 for gas-fired water heaters.

3.2.10.3 Connections to Water Heaters: Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.3 MISCELLANEOUS PLUMBING REPAIRS: Miscellaneous plumbing repairs shall include repair of all types of leaky faucets, shower and tub valves, sill cocks, boiler drains, water closet ballcocks, and water closet and urinal flush valves; replacement of leaky water closet floor flange seals and tank to bowl seals; and replacement of inoperative water closet flush handles.

3.4 PIPING AND FITTING TYPES AND APPLICATIONS: Piping and fittings shall be the types specified for the applications indicated below:

Application	Piping and Fitting Type
DWV piping systems in buildings, above or below ground, for new construction, renovation, or repair work.	PVC DWV pipe and fittings, ASTM D2665 or ABS DWV pipe and fittings, ASTM D2661.
DWV piping systems in buildings, above or below ground, for minor repair of existing cast iron hub and spigot type piping systems.	Cast iron hub and spigot DWV pipe and fittings, ASTM A74.
DWV piping systems in buildings, above or below ground, for minor repair of existing copper piping systems.	Copper DWV tube, ASTM B306 (Hard Temper); and copper solder joint fittings; ANSI B16.23 and ANSI B16.29.
DWV piping systems in buildings, above ground, for minor repair of existing galvanized steel piping systems.	Galvanized steel pipe, ASTM A53 (Type S, Grade B), and cast iron threaded fittings, ANSI B16.12.
Building sewer lateral piping, below ground, for new construction, renovation, or repair work.	ABS sewer pipe and fittings, ASTM D2751 (SDR 35 for 3 to 6 inch and SDR 42 for 8 to 12 inch).
Domestic water piping systems in buildings, above or below ground, for new construction, renovation, or repair work.	Copper water tube, ASTM B88 (Type L or K) and copper distribution tube, ASTM B641 (Type D); and copper solder joint fittings, ANSI B16.18 and ANSI B16.22.
Domestic water piping system buildings, above or below ground, minor repair of existing galvanized malleable iron fitting piping systems.	Galvanized steel pipe, ASTM A53 (Type S, Grade B), and galvanized malleable threaded fittings, ANSI B16.3.
Domestic water piping systems in buildings, above ground, for minor repairs of existing CPVC piping systems.	CPVC pipe, ASTM D2846, ASTM F441, or ASTM F442; and CPVC fittings, ASTM F437, ASTM F438, or ASTM F439.
Domestic water piping systems in buildings, above ground, for minor repairs of existing PB piping systems.	PB pipe, ASTM D2662 (PB2110, SIDR 11.5), ASTM D3000, or ASTM D3009 (PB2110, SIDR 11); and PB fittings ASTM D3009.
Building domestic water service piping, below ground, for new construction, renovation, or repair work.	Copper water tube, ASTM B88 (Type L or K) and copper distribution tube, ASTM B641 (Type D); and copper solder joint fittings, ANSI B16.18 and ANSI B16.22.
Compressed air piping systems in or adjacent to buildings, above or below ground, for new construction, renovation, or repair work.	Copper water tube, ASTM B88 (Type L or K); and copper solder joint fittings, ANSI B16.18 and ANSI B16.22.
Gas supply piping systems in buildings, above ground, for new construction, renovation, or repair work.	Black steel pipe, ASTM A53, (Type S, Grade B), and black malleable iron threaded fittings, ANSI B16.3.

3.5 TESTING: All plumbing systems shall be tested in accordance with the UPC or NAPHCC 01. Gas supply piping shall be tested in accordance with NFPA 54.

3.6 WATER AND SEWER SERVICE CONNECTIONS: Install water and sewer services in the building and connect them to existing Fort Riley water and sewer services indicated on the plans. Water and sewer service connections shall include all materials necessary to make a complete installation.

3.7 INSULATION: Domestic water piping shall be insulated as specified in SECTION 15250, THERMAL INSULATION FOR DOMESTIC AND HVAC PIPING, EQUIPMENT, AND DUCTWORK.

DIVISION 15 - MECHANICAL

SECTION 15488

NATURAL GAS PIPING

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of natural gas piping required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standards:

B1.20.1	Pipe Threads, General Purpose (Inch).
B16.3	Malleable Iron Threaded Fittings, Classes 150 and 300.
B16.5	Pipe Flanges and Flanged Fittings.
B16.9	Factory-Made Wrought Steel Buttwelding Fittings.
B16.11	Forged Steel Fittings, Socket-Welding and Threaded.
B16.21	Nonmetallic Flat Gaskets for Pipe Flanges.
B16.33	Manually Operated Gas Valves for Use in Gas Piping Systems up to 125 psi (Sizes 1/2 Through 2 Inch).
B31.1	Power Piping.
B31.2	Fuel Gas Piping.
Z21.24	Metal Connectors for Gas Appliances.

1.2.2 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC):

Section IX	Welding and Brazing Qualifications.

1.2.3 American Society for Testing and Materials (ASTM) Publications:

A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
A733	Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples.

1.2.4 Federal Specification (FS):

WW-U-531	Unions, Pipe, Steel or Malleable Iron; Threaded Connection, 150 LB, 250 LB, and 300 LB WSP.

1.2.5 Industrial Risk Insurers (IRI) Publication:

Section IV	Recommended Good Practices for Combustion Safeguards on Single Burner Boiler-Furnaces.

1.2.6 International Association of Plumbing and Mechanical Officials (IAPMO) Publication:

Uniform Plumbing Code (UPC).

1.2.7 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Publications:

SP 25	Standard Marking System for Valves, Fittings, Flanges, and Unions.
SP 58	Pipe Hangers and Supports - Materials, Design and Manufacture.
SP 69	Pipe Hangers and Supports - Selection and Application.
SP 78	Cast Iron Plug Valves, Flanged and Threaded Ends.
SP 84	Valves-Socket Welding and Threaded Ends.
SP 89	Pipe Hangers and Supports - Fabrication and Installation Practices.

1.2.8 Military Specification (MS):

MIL-T-27730	Tape, Antiseize, Polytetrafluoroethylene, with Dispenser.

1.2.9 National Association of Plumbing-Heating-Cooling Contractors (NAPHCC) Publication:

01	National Standard Plumbing Code (NSPC).

1.2.10 National Fire Protection Association (NFPA) Publications:

54	National Fuel Gas Code (NFGC).
70	National Electric Code (NEC).

1.2.11 Underwriters Laboratories (UL) Publication:

Gas and Oil Equipment Directory.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Shop Drawings: Submit shop drawings for proposed installation of new components and replacement of existing system components. Submit shop drawings for proposed additions and changes to natural gas piping systems.

1.3.3 As-Built Drawings: Submit as-built drawings for installation of new components and replacement of existing system components. Submit as-built drawings for additions and changes to natural gas piping systems.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 CONNECTORS: Metal connectors for gas appliances shall conform to ANSI Z21.24.

2.3 HANGERS AND SUPPORTS: Pipe hangers and supports shall conform to MSS SP 58, SP 69 and SP 89, and shall be of such materials and design as to rigidly secure piping without causing damage to the piping, fittings, or protective coatings.

2.4 PIPE, FITTINGS, AND ASSOCIATED MATERIALS:

2.4.1 Steel Pipe: Steel pipe shall conform to ASTM A53/A53M, Grade A or B, Type E or S, Schedule 40. Furnace buttwelded pipe may be used in sizes 1.5 inches and smaller.

2.4.2 Pipe Fittings, 1.5 Inches and Smaller: Fittings 1.5 inches and smaller shall conform to ANSI B16.3 and/or ANSI B16.11

2.4.3 Pipe Fittings, 2.0 Inches and Larger: Pipe flanges and flanged fittings including bolts, nuts, and bolt patterns shall be in accordance with ANSI B16.5, Standard Class. Buttweld fittings shall be in accordance with ANSI B16.9

2.4.4 Pipe Nipples: Pipe nipples shall conform to ASTM A733.

2.4.5 Pipe Threads: Pipe threads shall conform to ANSI B1.20.1.

2.4.6 Unions: Unions shall conform to FS WW-U-531.

2.4.7 Flange Gaskets: Gaskets shall be nonasbestos compressed material in accordance with ANSI B16.21, 0.0625 inch thickness, full face or self-centering flat ring type.

2.4.8 Sealants for Metallic Pipe Threaded Joints:

2.4.8.1 Antiseizing Tape: Tetrafluoroethylene tape shall conform to MS MIL-T-27730.

2.4.8.2 Sealing Compound: Joint sealing compound shall be as listed in the UL Gas and Oil Equipment Directory, Class 20 or less.

2.4.9 Insulating Joint Materials: Insulating joint materials shall be provided between flanged or threaded metallic pipe systems where shown to control galvanic or electrolytic action.

2.4.9.1 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.

2.4.9.2 Threaded Joints: Joints for threaded pipe shall be steel body nut type dielectric type unions with insulating gaskets.

2.4.10 Identification: Pipe flow markings and metal tags for each valve, meter, and regulator shall be in accordance with MSS SP 25.

2.5 SAFETY FEATURES FOR BOILER CONNECTIONS:

2.5.1 Main Valve Gas Train: Main valve gas trains shall have the following safety features: Two (2) safety shut-off valves, firing rate valve, manual leak test valve, manual shut-off valve, and gas pressure regulator vented outside of building.

2.5.2 Pilot Valve Gas Train: Pilot valve gas trains shall have the following safety features: safety shut-off valve, manual shut-off valve, normally open vent valve vented outside of building, and gas pressure regulator.

2.6 SERVICE BOXES: Service boxes shall be cast iron. Extension service boxes of the required length and having either screw or slide-type adjustment shall be installed at all service box locations. The boxes shall have housings of sufficient size to completely cover the service stop. Cover shall be cast iron with the word "GAS" cast in it.

2.7 VALVES: Valves shall conform to ANSI B16.33, MSS SP 78, or MSS SP 84 as appropriate for the application.

Description of Valve	Standard
Cast Iron Plug Valves	MSS SP 78
Steel Gas Valve, 0.5 thru 2.0 Inches, With Handwheel or Square Wrench Operator, Installed Above Ground	ANSI B16.33 and/or MSS SP 84

PART 3 EXECUTION

3.1 GENERAL: Install natural gas supply piping as indicated on the plans and specified herein.

3.2 INSTALLATION: Install gas piping and make appliance and equipment connections in accordance with ASME BPVC Sec IV, IRI Recommended Good Practices for Combustion Safeguards on Single Burner Boiler-Furnaces, ANSI B31.2, the UPC or NAPHCC 01, NFPA 54, the Contractor's approved shop drawings, and any applicable appliance or equipment manufacturer's written installation instructions. 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.

3.2.1 Metallic Piping Installation: 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.

3.2.2 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.

3.2.3 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.

3.2.4. 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 6 inches from nearest parallel wall in laundry areas where clothes hanging could be attempted.

3.3 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.

3.3.1 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 tetrafluoroethylene tape applied to the male threads only. Calking of threaded joints to stop or prevent leaks will not be permitted.

3.3.2 Welded Steel Joints: All 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 ANSI 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.

3.3.3 Welding Steel Piping: 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 Section IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ANSI 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.

3.3.4 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.

3.3.5 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.

3.4 PROTECTIVE COVERING:

3.4.1 Aboveground Metallic Piping Systems:

3.4.1.1 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 and primed

with ferrous metal primer. Primed surface shall be finished with two coats of exterior oil paint [or vinyl] paint.

3.4.1.2 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.

3.5 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 4.0 inches above finish floor. Unless otherwise indicated, sleeves shall be large enough to provide a minimum clearance of 0.25 inch 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. Except in pipe chases, interior walls, or fire-rated partitions, the annular space between pipe and sleeve shall be sealed with backstop material and sealant as specified in SECTION 07920, CALKING AND SEALANTS.

3.6 PIPES PENETRATING WATERPROOFING MEMBRANES: Pipes penetrating waterproofing membranes shall be installed as specified in SECTION 15400, PLUMBING.

3.7 FIRESTOPPING: Penetrations of fire rated partitions, walls and floors shall be in accordance with SECTION 07270, FIRESTOPPING.

3.8 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.

3.9 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.

3.10 BUILDING STRUCTURE: Building structure shall not be weakened by the installation of any gas piping. Beams or joists shall not be cut or notched.

3.11 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 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 0.125 inch shall be provided between the pipe and clip or clamp for all piping which may be subjected to thermal expansion.

3.12 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.

3.13 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.

3.14 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.

3.14.1 Pressure Tests: Before appliances are connected, piping systems shall be filled with air or an inert gas and shall withstand a minimum pressure of 3 pounds 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 0.1 pound. The source of pressure shall be isolated before the pressure tests are made.

3.14.2 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.

3.14.3 Purging: After testing is completed, and before connecting any appliances, all gas piping shall be fully purged. 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.

3.14.4 Labor, Materials and Equipment: All labor, materials and equipment necessary for conducting the testing and purging shall be furnished by the Contractor.

DIVISION 15 - MECHANICAL

SECTION 15510

HYDRONIC PIPING

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation of hydronic piping (dual temperature water, hot water, and chilled water piping) required in this contract.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standards:

B1.20.1	Pipe Threads, General Purpose (Inch).
B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 300.
B16.3	Malleable Iron Threaded Fittings.
B16.18	Cast Copper Alloy Solder Joint Pressure Fittings.
B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
B16.39	Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300.
B31.1	Power Piping.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

A53/A53M	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
B32	Solder Metal.
B88	Seamless Copper Water Tube.
B641	Seamless and Welded Copper Distribution Tube (Type D).

1.2.3 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Codes (BPVC):

Section IV	Heating Boilers.
Section VIII	Pressure Vessels.

1.2.4 Copper Development Association (CDA) Publication:

1.0	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube.

1.2.5 Federal Specifications (FS):

WW-N-351	Nipples, Pipe, Threaded.
WW-U-516	Unions, Brass or Bronze, Threaded Pipe Connections, and Solder-Joint Tube Connections.
WW-P-521	Pipe Fittings, Flange Fittings, and Flanges: Steel and Malleable Iron (Threaded) Class 150.
WW-U-531	Unions, Pipe, Steel or Malleable Iron: Threaded Connection, 150 LB, 250 LB and 300 LB.
QQ-B-654	Brazing Alloys, Silver.

1.2.6 International Association of Plumbing and Mechanical Officials (IAPMO) Publication:

Uniform Plumbing Code (UPC).

1.2.7 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Standards:

SP 58	Pipe Hangers and Supports - Materials, Design and Manufacture.
SP 69	Pipe Hangers and Supports - Selection and Application.
SP 70	Cast Iron Gate Valves, Flanged and Threaded Ends.
SP 73	Brazing Joints for Copper and Copper Alloy Pressure Fittings.
SP 78	Cast Iron Plug Valves, Flanged and Threaded Ends.
SP 80	Bronze Gate, Globe, Angle and Check Valves.
SP 83	Steel Pipe Unions Socket-Welding and Threaded.
SP 84	Steel Valves - Socket Welding and Threaded Ends.
SP 85	Cast Iron Globe and Angle Valves Flanged and Threaded Ends.
SP 89	Pipe Hangers and Supports - Fabrication and Installation Practices.

1.2.8 Military Specifications (MS):

MIL-P-17552	Pump Units, Centrifugal, Water, Horizontal; General Service and Boiler-Feed: Electric Motor or Steam Turbine Driven.
MIL-F-18113	Feeders, Boiler Water treatment, By-Pass and Compound Receiver Types.
MIL-V-18524	Valves, Radiator, Heating, Automatic Thermostatically Controlled (Self-Contained).
MIL-T-27730	Tape, Antiseize, Polytetrafluoroethylene, with Dispenser.

1.2.9 National Association of Plumbing-Heating-Cooling Contractors (NAPHCC) Publication:

01 National Standard Plumbing Code (NSPC).

1.2.10 Underwriters Laboratories (UL) Publication:

Gas and Oil Equipment Directory.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.2 Shop Drawings: Submit shop drawings for proposed installation of new components and replacement of existing system components. Submit shop drawings for proposed additions and changes to hydronic piping systems.

1.3.3 As-Built Drawings: Submit as-built drawings for installation of new components and replacement of existing system components. Submit as-built drawings for additions and changes to hydronic piping systems.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 CHEMICAL SHOT FEEDERS: Chemical shot feeders shall conform to MIL-F-18113. Feed size and capacity shall be based on local requirements and water analysis. Feeders shall be furnished with an air vent, gauge glass, funnel, valves, fittings, and piping.

2.4 EXPANSION TANKS: Expansion tanks shall have the capacity indicated. Pressurization system shall include a replaceable diaphragm-type captive air expansion tank which will accommodate the 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. The only air in the system shall be the permanent sealed-in air cushion contained in the diaphragm-type tank. Sizes shall be as indicated. Expansion tank shall be welded steel, constructed, tested and stamped in accordance with ASME BPV Sec VIII Div 1 for a working pressure of 125 psig minimum and precharged to the minimum operating pressure. Tank air chamber shall be fitted with an air charging valve. Tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations.

2.4.1 Air Separators: Single piece, cast iron chamber with two passages for water to flow. Separator shall include baffles and/or contours to provide efficient air separation. Separator shall include tappings for an automatic air vent, to provide complete and continuous air venting. Separator shall be a product of the expansion tank manufacturer, and shall be compatible with the expansion tank specified.

2.4.2 Automatic Fill Valves: All bronze construction with built-in pressure reducing capabilities and check valve to maintain minimum system pressure, and allow fast system filling. Valve shall have stainless steel screen and threaded connections. Automatic fill valve assembly shall be a product of the expansion tank manufacturer and be compatible with the expansion tank and air separator specified.

2.5 HANGERS AND SUPPORTS: Pipe hangers and supports shall conform to MSS SP 58, SP 69 and SP 89, and shall be of such materials and design as to rigidly secure piping without causing damage to the piping, fittings or insulation.

2.6 PIPE AND FITTINGS:

2.6.1 Copper Tubing and Fittings: Copper tubing shall conform to ASTM B88, Types L or K, or ASTM B641, Type D. Copper tubing fittings shall conform to ANSI B16.18 or ANSI B16.22.

2.6.2 Pipe Nipples: Pipe nipples shall conform to FS WW-N-351.

2.6.3 Pipe Threads: Pipe threads shall conform to ANSI B1.20.1.

2.6.4 Unions: Unions shall conform to FS WW-U-516, WW-U-531, ANSI B16.39 or MSS SP 83 as appropriate for the application.

2.7 PIPE JOINT MATERIALS: Joint materials shall conform to the following:

2.7.1 Brazing Alloy: Silver brazing alloy shall conform to FS QQ-B-654, Classification BCuP-5. Silver brazing alloy shall be used for all below ground solder joint fitting connections. Brazing shall conform to MSS SP 73.

2.7.2 Sealants for Metallic Pipe Threaded Joints:

2.7.2.1 Antiseizing Tape: Tetrafluoroethylene tape shall conform to MS MIL-T-27730.

2.7.2.2 Sealing Compound: Joint sealing compound shall be as listed in the UL Gas and Oil Equipment Directory, Class 20 or less.

2.7.3 Solder Flux: Solder Flux shall be liquid form, non-corrosive, and conform to CDA 1.0, Standard Test 1.

2.7.4 Solder Material: Solder metal shall conform to ASTM B32, 95-5 tin-antimony.

2.8 PUMPS:

2.8.1 Circulating Pumps: Circulating pumps shall be the type and have the capacities indicated. Pumps shall conform to MS MIL-P-17552, be single-stage centrifugal type, electrically driven. Pumps shall be supported on concrete foundations on which they are installed, and be either integrally mounted with the motors, or direct-connected by means of flexible shaft couplings on cast iron or steel subbases. Pump shafts shall be fabricated of alloy steel, with bronze sleeve bearings and gland seals, and close-grained cast iron housings. Motors shall have sufficient power for the capacities required, and be of a type approved by the manufacturer of the pumps. Electrical services shall be as recommended by the pump and motor manufacturer.

2.9 VALVES: Valves shall conform to MSS SP 70, SP 78, SP 80, SP 84, or SP 85 as appropriate for the application. Valves shall be the type and material which matches the valves being replaced.

Description of Valve	Standard
Bronze Gate, Globe, Angle, and Check Valves	MSS SP 80
Cast Iron Gate Valves, Flanged and Threaded Ends	MSS SP 70
Cast Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP 85
Cast Iron Plug Valves, Flanged and Threaded Ends	MSS SP 78
Steel Valves, Socket Welding and Threaded Ends	MSS SP 84

2.9.1 Air Vent Valves: Air vent valves shall be fully automatic quick-venting float and vacuum air valves. Air vent valves shall have a large portion permitting the expulsion of air without developing excessive back pressure, a noncollapsible metal float that will close the valve and prevent the loss of water from the system, and air seal that will effectively close and prevent the reentry 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.

2.9.2 Balancing Cocks: Balancing cocks 2 inches and smaller may be bronze or cast iron. Balancing cocks over 2 inches shall be cast iron. Balancing cocks shall have a square head or similar device with an indicator arc, and shall be designed for 120 psi service and 240 degrees F. Balancing cocks shall be lubricated, nonlubricated or tetrafluoroethylene coated plug or ball type valves.

PART 3 EXECUTION

3.1 GENERAL: Install hydronic piping (dual temperature water, hot water, and chilled water piping) and connect equipment as indicated on the plans and specified herein. Piping shall be copper.

3.2 INSTALLATION: Install hydronic piping and make equipment connections in accordance with the applicable portions of ANSI B31.1, ASME BPVC Sec IV, the UPC or NAPHCC 01, the Contractor’s approved shop drawings, and any applicable manufacturer’s written installation instructions.

3.3 TESTING: Test hydronic piping in accordance with ANSI B31.1 and ASME BPVC Sec IV.

3.4 INSULATION: Insulate hydronic piping in accordance with SECTION 15250, THERMAL INSULATION FOR DOMESTIC WATER AND HVAC PIPING, EQUIPMENT AND DUCTWORK.

DIVISION 15 - MECHANICAL

SECTION 15530

REFRIGERANT PIPING SYSTEMS

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of refrigerant piping systems required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 Air Conditioning and Refrigeration Institute (ARI) Standard:

710	Liquid Line Driers.

1.2.2 American National Standards Institute (ANSI) Standards:

B1.20.1	Pipe Threads, General Purpose (Inch).
B16.18	Cast Copper Alloy Solder Joint Pressure Fittings.
B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
B31.5	Refrigeration Piping.

1.2.3 American Society for Testing and Materials (ASTM) Publication:

B32	Solder Metal.
B280	Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

1.2.4 Copper Development Association (CDA) Publication:

1.0	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube.

1.2.5 Federal Specification (FS):

QQ-B-654	Brazing Alloys, Silver.

1.2.6 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Standards:

SP 58	Pipe Hangers and Supports - Materials, Design and Manufacture.
SP 69	Pipe Hangers and Supports - Selection and Application.
SP 73	Brazing Joints for Wrought and Cast Copper Alloy Solder Joint Pressure Fittings.
SP 80	Bronze Gate, Globe, Angle and Check Valves.

SP 89	Pipe Hangers and Supports - Fabrication and Installation Practices.

1.2.7 Military Specifications (MS):

MIL-V-20064	Valve, Nonferrous, For Use With Halogenated Refrigerants.
MIL-T-27730	Tape, Antiseize, Polytetrafluoroethylene, with Dispenser.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Shop Drawings: Submit shop drawings for proposed installation of new components and replacement of existing system components. Submit shop drawings for proposed additions and changes to refrigeration piping systems.

1.3.3 As-Built Drawings: Submit as-built drawings for installation of new components and replacement of existing system components. Submit as-built drawings for additions and changes to refrigeration piping systems.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturer's regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 HANGERS AND SUPPORTS: Pipe Hangers and supports shall conform to MSS SP 58, SP 69 and SP 89, and be of such materials and design as to rigidly secure piping without causing damage to the piping, fittings, or insulation.

2.3 LIQUID LINE FILTER-DRIERS: Liquid line filter-driers shall conform to ARI 710. Filter-driers 1/2 inch and smaller shall be sealed type, filter-driers 5/8 inch and larger shall be full-flow, replaceable core type. Filter-driers shall be installed on each liquid line and be piped with three-valve bypasses.

2.4 PIPE AND FITTINGS:

2.4.1 Copper Refrigeration Tube And Fittings: Copper refrigeration tube shall conform to ASTM B280. Copper refrigeration tube fittings shall conform to ANSI B16.18 or ANSI B16.22. Copper refrigeration tube and fittings shall also conform to the applicable portions of ANSI B31.5.

2.4.2 Pipe Threads: Pipe threads shall conform to ANSI B2.1.

2.5 PIPE JOINT MATERIALS:

2.5.1 Brazing Alloy: Silver brazing alloy shall conform to FS QQ-B-654, Classification BCuP-5. Silver brazing alloy shall be used for all below ground solder joint fitting connections. Brazing shall conform to MSS SP 73.

2.5.2 Sealants for Metallic Pipe Threaded Joints:

2.5.2.1 Antiseizing Tape: Tetrafluoroethylene tape shall conform to MS MIL-T-27730.

2.5.2.2 Sealing Compound: Not Used.

2.5.3 Solder Flux: Solder Flux shall be liquid form, non-corrosive, and conform to CDA 1.0, Standard Test 1.

2.5.4 Solder Material: Solder metal shall conform to ASTM B32, 95-5 tin-antimony.

2.6 VALVES: Valves shall conform to MS MIL-V-20064 and MSS SP 80 as appropriate for the application. Valves shall be the type and material which matches the valves being replaced.

Description of Valve	Standard
Bronze Gate, Globe, Angle, and Check Valves	MSS SP 80
Valve, Nonferrous, For Use With Halogenated Refrigerants	MIL-V-20064

PART 3 EXECUTION

3.1 GENERAL: Install refrigerant piping and connect equipment as indicated on the plans and specified herein.

3.2 INSTALLATION: Install refrigerant piping and make equipment connections in accordance with ANSI B31.5, MSS SP 73, the Contractor’s approved shop drawings, and any applicable equipment manufacturer’s written installation instructions.

3.3 TESTING: Test refrigerant piping in accordance with ANSI B31.5 prior to purging and charging.

3.4 PURGING AND CHARGING: Field-charged refrigerant piping shall be purged with nitrogen or refrigerant and evacuated with an evacuation pump prior to charging with the required refrigerant. Charging shall be accomplished in accordance with the equipment manufacturer’s written instructions.

3.5 INSULATION: Insulate refrigerant piping in accordance with SECTION 15250, THERMAL INSULATION FOR DOMESTIC WATER AND HVAC PIPING, EQUIPMENT AND DUCTWORK.

DIVISION 15 - MECHANICAL

SECTION 15550

HEAT GENERATING EQUIPMENT

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation of heat generating equipment including boilers, boiler accessories; breechings, chimneys, and stacks; feedwater equipment, fuel handling systems, forced-air furnaces, and fuel-fired heaters required in this contract.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 Air Conditioning and Refrigeration Institute (ARI) Standard:

430 Central-Station Air-Handling Units.

1.2.2 Air Movement and Control Association (AMCA) Standards:

210 Laboratory Methods of Testing Fans for Rating Purposes.

300 Reverberant Room Method for Sound Testing of Fans.

1.2.3 American National Standards Institute (ANSI) Standards:

B31.1 Power Piping.

Z21.13 Gas-Fired and Hot Water Boilers.

Z83.4 Direct Gas-Fired Make-Up Air Heaters.

1.2.4 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC):

Section IV Heating Boilers.

1.2.5 Anti-Friction Bearing Manufacturers Association (AFBMA) Standards:

9 Load Ratings and Fatigue Life for Ball Bearings.

10 Metal Balls.

1.2.6 Commercial Item Description (CID):

A-A-1419 Filter Element, Air Conditioning (Viscous-Impingement and Dry Types, Replaceable).

1.2.7 Hydronics Institute (HYI) Standard:

01 I=B=R Ratings for Boilers, Baseboard Radiation and Finned Tube (Commercial) Radiation.

1.2.8 Industrial Risk Insurers (IRI) Publications:

Section IV	Recommended Good Practices for Combustion Safeguards on Single Burner Boiler-Furnaces.

1.2.9 National Electrical Manufacturers Association (NEMA) Standard:

MG 1	Motors and Generators.

1.2.10 National Association of Plumbing-Heating-Cooling Contractors (NAPHCC) Standard:

01	National Standard Plumbing Code.

1.2.11 National Fire Protection Association (NFPA) Standards:

54	National Fuel Gas Code (NFGC).
70	National Electrical Code (NEC).
85A	Prevention of Furnace Explosions in Fuel Oil- and Natural Gas-Fired Single Burner Boiler-Furnaces.
90A	Installation of Air Conditioning and Ventilating Systems.
90B	Installation of Warm Air Heating and Air Conditioning Systems.
211	Chimney, Fireplaces, Vents, and Solid Fuel-Burning Appliances.
8501	Single Burner Boiler Operations.

1.2.12 Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Standard:

HVAC Duct Construction Standards - Metal and Flexible.

1.2.13 Underwriters Laboratories (UL) Publications:

372	Primary Safety Controls for Gas- and Oil-Fired Appliances.
873	Temperature-Indicating and Regulating Equipment.
900	Test Performance of Air Filter Units.
1995	Safety of Heating and Cooling Equipment.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive and technical literature including performance charts and curves for all major materials proposed for use in work under this section.

1.3.2 Installation, Operation, and Maintenance Instructions: Submit manufacturer's written installation, operation, and maintenance instructions.

1.3.3 Shop Drawings: Submit shop drawings for proposed installation of new components and replacement of existing system components. Submit shop draw-

ings for proposed additions and changes to HVAC systems. 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.

1.3.4 As-Built Drawings: Submit as-built drawings for installation of new components and replacement of existing system components. Submit as-built drawings for additions and changes to HVAC systems.

1.3.5 Test Results: Submit test results for all testing required under this section.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 BOILERS: Boilers shall be the type and capacity indicated when fired with the specified fuels. Boiler capacities shall be based on the ratings shown in HYI-01 or as certified by the ABMA or AGA. Gas fired units less than 12,500,000 Btuh input shall conform to ANSI Z21.13. Single and multiple burner gas-fired units greater than or equal to 12,500,000 Btuh input shall conform to NFPA 8501. Boilers shall be designed, constructed, and equipped in accordance with ASME BPVC Sec IV. Boilers shall be furnished complete with the fuel burning equipment, boiler fittings and trim, automatic controls, draft fan(s), electrical wiring, insulation, piping connections, and protective jacket. Burners shall have electronic ignition. Boilers 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. Boiler safety devices shall not be sized for a 10 percent excess capacity. Boilers and their accessories shall be designed and installed to permit ready accessibility for operation, maintenance, and service.

2.2.4 Modular Boilers: Modular boilers shall utilize pulse combustion and shall have minimum efficiency rating of 90 percent. Boiler systems shall come complete with individual boilers, piping kits, PRV’s, high limit switches, condensate drains, PVC flues and intakes, gas valves, vent terminations, mufflers on intake and exhaust and reset controls. Furnish outdoor reset supply water temperature control to sequence firing of heating modules. Controls shall come with all aquastat, limit switches and main panel necessary for a proper operation.

2.11 GAS-FIRED MAKE-UP AIR HEATERS: Indirect Gas-fired make-up air heaters shall conform to ANSI Z83.4. Make-up air heaters use outside air directly ducted to the heater. The products of combustion generated by the heater are released through the heat exchanger and vent to the atmosphere. Heaters shall be equipped with backdraft dampers, air filters, and bird screen on outside air intake. Heaters shall have electronic ignition. Gas control valve shall be modulating type. Outdoor heaters shall be weatherized and shall have manufacturer's standard exterior finish for outdoor units. Motorized 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 space or discharge air thermostat, a low limit air stream thermostat, and an ambient air thermostat. The space or 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 thermostat setting. The ambient air thermostat shall shut down the burner if the outside air exceeds the thermostat setting.

2.12 CONTROL EQUIPMENT: Control equipment shall be the type recommended by the equipment manufacturer and conform to UL 873 and IRI Section IV. Heaters shall be furnished with gas pressure regulators that will satisfactorily limit main gas burner supply pressure. Safety controls shall conform to the ANSI standard specified for each heater. Thermostats shall be compatible with the type of equipment being controlled, and shall match the type and size of the thermostats being replaced.

2.13 FANS AND MOTORS: Fans shall have the capacities to produce the air flows required and shall be tested and rated in accordance with AFBMA 9 and 10. Fan sound power level valves shall be obtained in accordance with AMCA 210 and 300. Fan motors shall conform to NEMA MG 1.

2.14 FILTERS: Air filters shall conform to CID A-A-1419 and shall be listed in accordance with the requirements of UL 900.

2.14.1 Filter Design: Sectional throwaway filters shall be 2 inches thick, and of size required to suit application. Air flow capacity of clean filters shall be based on net filter face velocity not exceeding 360 FPM with initial resistance of 0.12 inch water.

2.14.2 Holding Frames: Holding frames for sectional filters shall be fabricated from not lighter than 16-gauge sheet steel with rust-inhibitor coating. Each holding frame shall be gasketed. Where indicated or required, filter bank shall be erected, and all joints shall be gasketed and airtight.

PART 3 EXECUTION

3.1 GENERAL: Install heat generating equipment including boilers, boiler accessories; breechings, chimneys, and stacks; feedwater equipment, fuel handling systems, forced-air furnaces, and fuel-fired heaters as indicated on the plans and specified herein.

3.2 INSTALLATION: Install heat generating equipment and components in accordance with the manufacturer’s written installation, operation, and maintenance instructions; NAPHCC-01; and the requirements herein. Installation of new boilers and related components shall include all incidental items necessary to make complete operational installations.

3.2.1 Equipment Insulation: Equipment insulating shall be supplied by the manufacturer or accomplished in accordance with SECTION 15250, THERMAL INSULATION FOR DOMESTIC WATER AND HVAC PIPING, EQUIPMENT, AND DUCTWORK.

3.2.2 Piping Connections: Make piping connections in accordance with ANSI B31.1; NFPA 54; NFPA 211; SECTION 15400, PLUMBING; SECTION 15488, NATURAL GAS PIPING; SECTION 15510, HYDRONIC PIPING; SECTION 15520, STEAM AND STEAM CONDENSATE PIPING; and SECTION 15530, REFRIGERANT PIPING.

3.2.3 Ductwork Connections: Make ductwork connections in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, NFPA 90A and 90B, and SECTION 15880, AIR DISTRIBUTION EQUIPMENT.

3.2.4 Electrical Supply Connections: Make electrical supply connections in accordance with NFPA 70 and SECTION 16050, ELECTRICAL.

3.3 TESTING, ADJUSTING, AND BALANCING:

3.3.1 General: Furnish the necessary equipment, instruments, facilities, and technically qualified personnel to perform the following tests.

3.3.2 Operational Tests: Following installation of forced-air furnaces and heaters, and ductwork if applicable, perform operational tests to demonstrate satisfactory functioning and operating effectiveness. Utilize manufacturers' specifications as standards for the testing. Following installation of boilers, fire boilers, tune for maximum efficiency, and test in accordance with ASME BPVC Sec IV and NFPA 85A. Submit written test results to the Contracting Officer.

3.3.3 Testing, Adjusting, and Balancing: Following installation of forced-air furnaces and ductwork perform testing, adjusting, and balancing of the systems in accordance with SECTION 15990, TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Submit written test results to the Contracting Officer.

DIVISION 15 - MECHANICAL

SECTION 15650

REFRIGERATION EQUIPMENT

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation of refrigeration equipment including compressors, condensing units, water chillers, cooling towers, liquid coolers, and condensers required in this contract.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 Air Conditioning and Refrigeration Institute (ARI) Standards:

365	Commercial and Industrial Unitary Air conditioning Condensing Units.
460	Remote Mechanical-Draft Air-Cooled Refrigerant Condensers.
490	Remote Mechanical-Draft Evaporative Refrigerant Condensers.
495	Refrigerant Liquid Receivers.
520	Positive Displacement Refrigerant Compressors, Compressor Units and Condensing Units.
550	Centrifugal or Rotary Screw Water-Chilling Packages.
590	Reciprocating Water-Chilling Packages.
700	Specifications for Fluorocarbon and Other Refrigerants.
710	Liquid-Line Driers.

1.2.2 American Bearing Manufacturers Association (ABEMA) Publications:

9	Load Ratings and Fatigue Life for Ball Bearings.
11	Load Ratings and Fatigue Life for Roller Bearings.

1.2.3 American Society for Testing and Materials (ASTM) Publications:

A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
A307	Carbon Steel Bolts.
B117	Operating Salt Spray (Fog) Testing Apparatus.

C534	Flexible Elastomeric Cellular Thermal Insulation.
D520	Zinc Dust Pigment.
D1384	Corrosion Test for Engine Coolants.
D1784	Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
E84	Surface Burning Characteristics of Building Materials.
F104	Non-metallic Gasket Materials.

1.2.4 American Society of Heating, Refrigerating and Air conditioning Engineers (ASHRAE) Publications:

15	Safety Code for Mechanical Refrigeration.
34	Number Designation and Safety Classification of Refrigerants.
64	Methods of Testing Remote Mechanical-Draft Evaporative Refrigerant Condensers.

1.2.5 American Society of Mechanical Engineers (ASME) Standards and Boiler and Pressure Vessel Codes (BPVC):

B31.1	Power Piping.
B31.5	Refrigeration Piping.
Section VIII Division 1	Pressure Vessels, Basic Coverage.
Section IX	Welding and Brazing Qualifications.
PTC 23	Atmospheric Water Cooling Equipment.

1.2.6 Hydraulic Institute (HI) Standard:

01	Centrifugal, Rotary, and Reciprocating Pumps.

1.2.7 National Electrical Manufacturers Association (NEMA) Publications:

250	Enclosures for Electrical Equipment (1000 Volts Maximum).
ICS 1	Industrial Control and Systems Equipment.
ICS 2	Industrial Control and Systems Controllers.
ICS 6	Industrial Control and Systems Enclosures.
MG 1	Motors and Generators.
SM 23	Steam Turbines for Mechanical Drive Service.

1.2.8 National Fire Protection Association (NFPA) Standards:

37	Stationary Combustion Engines and Gas Turbines.

54	National Fuel Gas Code.
70	National Electrical Code.
90A	Installation of Air Conditioning and Ventilating Systems.
211	Chimneys, Fireplaces, Vents, and Solid-Fuel Appliances.
214	Water-Cooling Towers.
255	Method of Test of Surface Burning Characteristics of Building Materials.

1.2.9 Society of Automotive Engineers (SAE) Standard:

J 537	Storage Batteries.

1.2.10 Underwriters Laboratories (UL) Standards:

207	Refrigerant-Containing Components and Accessories.
1236	Battery Chargers for Charging Engine-Starter Batteries.
1995	Heating and Cooling Equipment.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer’s descriptive and technical literature including performance charts and curves for all major materials proposed for use in work under this section.

1.3.2 Installation, Operation, and Maintenance Instructions:

1.3.2.1 Operation Manual: Six complete copies of an operation manual in bound 8 1/2 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.

1.3.2.2 Maintenance Manual: Six complete copies of maintenance manual in bound 8 1/2 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.

1.3.3 Shop Drawings: Submit shop drawings for proposed installation of new components and replacement of existing system components. Submit shop drawings for proposed additions and changes to HVAC systems.

1.3.4 As-Built Drawings: Submit as-built drawings for installation of new components and replacement of existing system components. Submit as-built drawings for additions and changes to HVAC systems. 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.

1.3.5 System Performance Tests: Six copies of the report shall be provided in bound 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:

1.3.5.1 Date and outside weather conditions.

1.3.5.2 The load on the system based on the following:

- The refrigerant used in the system.
- Condensing temperature and pressure.
- Suction temperature and pressure.
- Running current, voltage and proper phase sequence for each phase of all motors.
- The actual on-site setting of all operating and safety controls.
- Chilled water quantity and temperature in and out of the chiller.

1.3.6 Certificates: 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 the delivery order scope of work 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.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 WATER CHILLERS:

2.2.1 Self-Contained Liquid Chiller: Unless necessary for delivery purposes, units shall be assembled, leak-tested, charged (refrigerant and oil), and adjusted at the factory. In lieu of delivery constraints, a chiller may be assembled, leak-tested, charged (refrigerant and oil), and adjusted at the job site by a factory representative. Unit components delivered separately shall be sealed and charged with a nitrogen holding charge. Unit assembly shall be completed in strict accordance with manufacturer's recommendations. Chiller shall operate within capacity range and speed recommended by the manufacturer. Parts weighing 50 pounds or more which must be removed for inspection, cleaning, or repair, such as motors, gear boxes, cylinder heads, casing tops, condenser, and cooler heads, shall have lifting eyes or lugs. Chiller shall be provided with factory installed insulation on surfaces subject to sweating in-

cluding the liquid cooler, suction line piping, economizer, and cooling lines. Chiller shall include all customary auxiliaries deemed necessary by the manufacturer for safe, controlled, automatic operation of the equipment. Chiller shall be provided with a single point wiring connection for incoming power supply. Factory installed insulation shall be provided on all suction piping from the evaporator to the compressor and on the liquid cooler shell. Where motors are the gas-cooled type, factory installed insulation shall be provided on the cold-gas inlet connection to the motor per manufacturer's standard practice. Chiller's condenser and liquid cooler shall be provided with standard water boxes with flanged or welded connections.

2.2.1.1 Scroll, Reciprocating, or Rotary Screw Type: Chiller shall be constructed and rated in accordance with ARI ANSI/ARI 550 or ARI ANSI/ARI 590 as applicable. Chiller shall be conform to ASHRAE 15. As a minimum, chiller shall include the following components as defined in paragraph CHILLER COMPONENTS.

- Refrigerant and oil.
- Structural base.
- Controls package.
- Scroll, reciprocating, or rotary screw compressor.
- Compressor driver, electric motor or gas-engine, as applicable.
- Compressor driver connection.
- Liquid cooler (evaporator).
- Air or Water condenser coil, as applicable.
- Tools.
- Chiller refrigerant circuit.

2.3.1.1 Capacity Criteria: Units shall have the minimum Coefficient of Performance (COP) at full load rating and the minimum Integrated Part Load Value (IPLV), rated in accordance with ARI 590, as indicated below:

	Full Load *(COPs)	**IPLV *(COPs)**
Air-Cooled with Condenser:		
500 kW and over	2.5	2.5
less than 500 kW	2.7	2.8

* Units are Btuh output / Btuh input

2.3.3 Chiller Components:

2.3.3.1 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.

2.3.3.2 Structural Base: Chiller and individual chiller components shall be provided with a factory-mounted welded structural steel base or support legs. Chiller and individual chiller components shall be isolated from the building structure by means of 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.

2.3.3.3 Chiller Refrigerant Circuit: Chiller refrigerant circuit shall be completely piped and factory leak tested. For multicompressor units, not less than 2 independent refrigerant circuits shall be provided. Circuit shall include as a minimum a combination filter and drier, combination sight glass and moisture indicator, liquid-line solenoid valve for reciprocating or scroll units, an electronic or thermostatic expansion valve with external equalizer, charging ports, compressor service valves, and superheat adjustment.

2.3.3.4 Controls Package: Chiller shall be provided with a complete factory mounted and prewired electric or microprocessor based control system. Controls package shall be unit-mounted which contains as a minimum a digital display or acceptable gauges, an on-auto-off switch, motor starters, power wiring, control wiring, and disconnect switches. Controls package shall provide operating controls, monitoring capabilities, programmable setpoints, safety controls, and EMCS interfaces as defined below.

2.3.3.4.1 Operating Controls: Chiller shall be provided with the following adjustable operating controls as a minimum.

- Leaving chilled water temperature control.
- Adjustable timer to prevent compressor from short cycling.
- Automatic lead/lag controls (adjustable) for multiprocessor units.
- Load limiting.
- Fan sequencing for air-cooled condenser.
- System capacity control to adjust the unit capacity in accordance with the system load and the programmable setpoints. Controls shall automatically re-cycle the chiller on power interruption.
- Startup and head pressure controls to allow system operation at all ambient temperatures under which the unit may be operated.

2.3.3.4.2 Monitoring Capabilities: During normal operations, the control system shall be capable of monitoring and displaying the following operating parameters. Access and operation of display shall not require opening or removing any panels or doors.

- Entering and leaving chilled water temperatures.
- Self diagnostic.
- Operation status.
- Operating hours.
- Number of starts.
- Compressor status (on or off).
- Refrigerant discharge and suction pressures.
- Condenser water entering and leaving temperatures.

2.3.3.4.3 Programmable Setpoints: The control system shall be capable of being reprogrammed directly at the unit. No parameters shall be capable of being changed without first entering a security access code. The programmable setpoints shall include the following as a minimum.

- Leaving Chilled Water Temperature.
- Leaving Condenser Water Temperature.
- Time Clock/Calendar Date.

2.3.3.4.4 Safety Controls with Manual Reset: Chiller shall be provided with the following safety controls which automatically shutdown the chiller and which require manual reset.

- Low chilled water temperature protection.
- High condenser refrigerant discharge pressure protection.
- Low suction pressure protection.
- Chilled water flow detection.
- Motor current overload and phase loss protection.
- High motor winding temperature protection for hermetic motors.
- Low oil flow protection.

2.3.3.4.5 Safety Controls with Automatic Reset: Chiller shall be provided with the following safety controls which automatically shutdown the chiller and which provide automatic reset.

- Over/under voltage protection.
- Phase reversal protection.
- Chilled water flow interlock.

2.3.3.4.6 Remote Alarm: During the initiation of a safety shutdown, the control system shall be capable of activating a remote alarm bell. In coordination with the chiller, the contractor shall provide an alarm circuit (including transformer if applicable) and a minimum 4 inch diameter alarm bell. Alarm circuit shall activate bell in the event of machine shutdown due to the chiller's monitoring of safety controls. The alarm bell shall not sound for a chiller that uses low-pressure cutout as an operating control.

2.3.3.4.7 Energy Management Control System (EMCS) Interface: The control system shall be capable of communicating all data to a remote integrated DDC processor through a single shielded cable. The data shall include as a minimum all system operating conditions, capacity controls, and safety shutdown conditions. The control system shall also be capable of receiving at a minimum the following operating commands.

- Remote Unit Start/Stop.
- Remote Chilled Water Reset.
- Remote Condenser Water Reset.

2.3.3.5 Compressor(s):

2.3.3.5.3 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:

- 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.
- Rotors which are solid steel forging with sufficient rigidity for proper operation.
- A maximum rotor operating speed no greater than 3600 RPM.
- Casings of cast iron, precision machined for minimal clearance about periphery of rotors.
- A lubrication system of the forced-feed type that provides oil at the proper pressure to all parts requiring lubrication.
- 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. Bear-

ings shall be conservatively loaded and rated for an L(10) life of not less than 200,000 hours.

- 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.
- 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.
- An oil separator and oil return system to remove oil entrained in the refrigerant gas and automatically return the oil to the compressor.
- Crankcase oil heaters controlled as recommended by the manufacturer.

2.3.3.5.5 Compressor Driver, Electric Motor: Motor shall be the polyphase, induction type conforming to NEMA MG 1. Motors shall be suitable for use with the indicated electrical power characteristics and the type of starter provided. Motor starters shall be the reduced voltage, closed-transition type conforming to NEMA ICS 1 and NEMA ICS 2. Motor starter shall be unit mounted or remote mounted as indicated with starter type, wiring, and accessories coordinated by the chiller manufacturer. Starter shall be able to operate in temperatures up to 120 degrees F.

2.3.3.5.6.1 Starting System: Engine starting system shall be the electric type and be of sufficient capacity, at the maximum temperature specified, to crank the engine without damage or overheating. Electric starting system shall operate on a DC system utilizing a negative circuit ground. A starting battery system shall be provided and shall include the battery, corrosion resistant battery rack, intercell connectors, spacers, automatic engine driven battery charger with overcurrent protection, metering and relaying. Battery shall be in accordance with SAE J 537. Battery charger shall conforming to UL 1236 and be the current-limiting type with overcurrent protection.

2.3.3.5.6.2 Lubrication System: Engine shall be provided with a pressurized oil lubrication system. System shall include a lubrication oil pump that is engine driven. One full-flow filter shall be provided for each pump. Filters shall be readily accessible and capable of being changed without disconnecting the piping or disturbing other components. System pressure shall be regulated as recommended by the engine manufacturer. A pressure relief valve shall be provided on the crankcase. Crankcase breathers shall be piped to the outside. System shall be readily accessible for servicing such as draining, refilling, and overhauling.

2.3.3.5.6.3 Coolant System: Engine shall include an automatic engine jacket water cooling system. Water shall be circulated through the system with an engine-driven circulating pump. System coolant shall use a combination water and ethylene-glycol sufficient for freeze protection at the minimum temperature specified.

2.4 ACCESSORIES:

2.4.1 Pumps: Pumps shall be the electrically driven, non-overloading, centrifugal type which conform to HI ANSI/HI 1.1-1.5. 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. Pump motor shall be totally enclosed and have sufficient 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.

2.4.1.1 Construction: Shaft seal shall be mechanical-seal type. Impeller shall be statically and dynamically balanced. Each pump casing shall be de-

signed to withstand the discharge head specified plus the static head on system plus 50 percent of the total, but not less than 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 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 60 feet of water, the pump speed shall not exceed 1,750 rpm. Pump shall be accessible for servicing without disturbing piping connections.

2.4.1.2 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 or ceramic 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.

2.4.2 Expansion Tanks: Refer to SECTION 15510, HYDRONIC PIPING.

2.4.3 Air Separators: Refer to SECTION 15510, HYDRONIC PIPING.

2.4.4 Automatic Fill Valves: Refer to SECTION 15510, HYDRONIC PIPING.

2.4.5 Refrigerant Leak Detector: A refrigerant leak detector shall be provided in any mechanical room or enclosed area which houses a liquid chiller. The detector shall be located where refrigerant is likely to concentrate. The detector shall be a Halogen-Specific detector, which shall be specifically designed for area monitoring. The detector shall have an adjustable sensitivity such that it can detect refrigerant at or above 3 ppm. The detector shall energize the local mechanical ventilation system and initiate an audible and visible alarm upon detecting a refrigerant level greater than 10 ppm.

2.4.7 Insulation:

2.4.7.1 Field Installed Insulation: Field installed insulation shall be as specified in SECTION 15250, THERMAL INSULATION FOR DOMESTIC WATER AND HVAC PIPING, EQUIPMENT, AND DUCTWORK.

2.4.7.2 Factory Installed Insulation: For liquid-chilling packages (reciprocating, scroll, or screw), closed cell 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.

2.4.8 Gaskets: Gaskets shall conform to ASTM F104 - classification for compressed sheet with nitrile binder and acrylic fibers for maximum 700 degrees F service.

2.4.9 Bolts and Nuts: Bolts and nuts, except as required for piping applications, shall be in accordance with ASTM A307. The bolt head shall be marked to identify the manufacturer and the standard with which the bolt complies in accordance with ASTM A307.

2.5 FABRICATION:

2.5.1 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 B117 using a 5 percent sodium chloride solution. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D520, Type I.

2.5.2 Field Painting: Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory are specified in SECTION 09910, EXTERIOR PAINTING.

PART 3 EXECUTION

3.1 GENERAL: Install refrigeration equipment including compressors, condensing units, water chillers, cooling towers, liquid coolers, and condensers and their components as indicated on the plans and specified herein.

3.2 INSTALLATION: Install refrigeration equipment and components in accordance with NFPA 90A and the manufacturer's published diagrams, recommendations, and equipment warranty requirements. Where equipment is specified to conform to the requirements of ASME BPVC Sec VIII Div 1 and ASME BPVC Sec IX, the design, fabrication, and installation of the system shall conform to ASME BPVC Sec VIII Div 1 and ASME BPVC Sec IX. Installation of new refrigeration equipment and related components shall include all incidental items necessary to make complete operational installations.

3.2.1 Equipment Insulation: Equipment insulating shall be supplied by the manufacturer or accomplished in accordance with SECTION 15250, THERMAL INSULATION FOR DOMESTIC AND HVAC PIPING, EQUIPMENT AND DUCTWORK.

3.2.2 Piping Connections: Make piping connections in accordance with ASME B31.1; NFPA 54; NFPA 211; SECTION 15400, PLUMBING; SECTION 15488, NATURAL GAS PIPING; SECTION 15510, HYDRONIC PIPING; SECTION 15520, STEAM AND STEAM CONDENSATE PIPING; and SECTION 15530, REFRIGERANT PIPING.

3.2.3 Electrical Supply Connections: Make electrical supply connections in accordance with NFPA 70 and SECTION 16050, ELECTRICAL.

3.2.4 Refrigeration System:

3.2.4.1 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 6 inch concrete 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. Equipment shall be properly leveled, aligned, and secured in place in accordance with manufac-

turer's instructions.

3.2.5.2 Refrigerant Charging:

3.2.5.2.1 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.

3.2.5.2.2 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.

3.2.5.2.3 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 (3 oz.) 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.

3.2.5.3 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.

3.2.5.4 Automatic Controls: Automatic controls for the central 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 existing air conditioning system.

3.2.5.6 Factory Applied Insulation:

3.2.5.6.1 Refrigerant Suction Lines: Refrigerant suction lines shall be insulated with not less than 3/4 inch thick unicellular plastic foam.

3.2.5.6.2 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 3/4 inch thick. In lieu of the above insulation, 2 inch thickness of urethane foam may be used. Urethane foam shall be completely covered and sealed with a sheet metal jacket not lighter than 20 gauge. Insulation on heads of coolers shall be constructed to provide easy removal and replacement of heads without damage to the insulation.

3.3 TESTS:

3.3.1 Refrigerant Pipe Testing:

3.3.1.1 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 0.3 psi shall be allowed for each degree F change 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.

3.3.1.2 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.

3.3.1.3 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. (35 degrees F.) 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.

3.3.3 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 demonstrate that the entire system is functioning in accordance with the manufacturer's recommendations and the delivery order. Corrections and adjustments shall be made as necessary and tests shall be reconducted to demonstrate that the entire system is functioning as specified.

3.4 MANUFACTURER'S FIELD SERVICE: The services of a factory-trained representative shall be provided at the site to advise on the following:

3.4.1 Hermetic Machines:

3.4.1.1 Testing hermetic water-chilling unit under pressure for refrigerant leaks; evacuation and dehydration of machine to an absolute pressure of not over 300 microns.

3.4.1.2 Charging the machine with refrigerant.

3.4.1.3 Starting the machine.

3.5 CLEANING AND ADJUSTING: 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 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.

DIVISION 15 - MECHANICAL

SECTION 15850

AIR HANDLING EQUIPMENT

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation of air handling equipment including air handling units with coils, centrifugal fans, axial fans, power ventilators, air curtain units, and radon mitigation systems required in this contract.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 Air Conditioning and Refrigeration Institute (ARI) Standards:

410	Forced-Circulation Air-Cooling and Air-Heating Coils.
430	Central-Station Air-Handling Units.

1.2.2 Air Movement and Control Association (AMCA) Standards:

210	Laboratory Methods of Testing Fans for Rating Purposes.
300	Reverberant Room Method for Sound Testing of Fans.

1.2.3 Anti-Friction Bearing Manufacturers Association (AFBMA) Standards:

9	Load Ratings and Fatigue Life for Ball Bearings.
10	Metal Balls.

1.2.4 Commercial Item Description (CID):

A-A-1419	Filter Element, Air Conditioning (Viscous-Impingement and Dry Types, Replaceable).

1.2.6 National Electrical Manufacturers Association (NEMA) Publication:

MG 1	Motors and Generators.

1.2.7 National Fire Protection Association (NFPA) Standard:

70	National Electrical Code (NEC).

1.2.8 Underwriters Laboratories (UL) Publications:

705	Power Ventilators.
900	Test Performance of Air Filter Units.
1571	Incandescent Lighting Fixtures.

1.2.9 U.S. Environmental Protection Agency (EPA) Publications:

402-R-93-078 Radon Mitigation Standards.

625-R-93-011 Radon Reduction Techniques for Existing Houses.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation, Operation, and Maintenance Instructions: Submit manufacturer's written installation, operation, and maintenance instructions.

1.3.3 Shop Drawings: Submit shop drawings for proposed installation of new components and replacement of existing system components. Submit shop drawings for proposed additions and changes to HVAC systems.

1.3.4 As-Built Drawings: Submit as-built drawings for installation of new components and replacement of existing system components. Submit as-built drawings for additions and changes to HVAC systems.

1.3.5 Test Results: Submit test results for all testing required under this section.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturer's regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 AIR HANDLING UNITS WITH COILS: Air handling units shall be low pressure single-zone draw-through type unless otherwise specified, and shall conform to ARI 430. The unit shall include a fan, coils, airtight insulated casing, filters, motor, direct or adjustable V-belt drive, belt guard, and access sections, combination sectional filter-mixing box, vibration isolators, and appurtenances required for the operation of the unit. Vibration isolators shall be combination rubber-in-shear/spring type for units designated for low pressure duty. Each air handling unit shall have physical dimensions suitable to fit space allotted to the unit.

2.2.1 Casing: Casing of each unit section shall be constructed of not lighter than 18-gauge galvanized steel or not lighter than 18-gauge steel protected with the manufacturer's standard finish except that units with an all-welded structural steel frame shall have individually removable flush-mounted panels not lighter than 20-gauge steel or 20-gauge galvanized steel. Drain pan shall be of not lighter than 18-gauge galvanized steel, coated with waterproofing material. The drain pan shall be insulated at the factory to protect against condensation. A double-bottom type drain pan constructed with 1/2-inch or more enclosed insulating air space between the two pans will be acceptable. The inside pan shall be all-welded construction and shall be coated with waterproofing material. Each casing section shall be acoustically and thermally insulated at the factory with not less than 1 inch thick, 3-pound density neoprene coated fibrous glass material. Insulation edges shall be protected with metal nosing. Where edges of exposed insulation are butted together, the joint shall be covered with a protective metal strip fastened in an approved manner. Access doors or removable panels where required for servicing shall be provided in the fan-coil section.

2.2.2 Coils: Heating and cooling coils shall conform to SECTION 15750, HEAT TRANSFER EQUIPMENT.

2.2.3 Fans and Motors: Fans shall have the capacities to produce the CFM's required and shall be tested and rated in accordance with AFBMA 9 and 10. Fan sound power level valves shall be obtained in accordance with AMCA 210 and 300. Fan motors shall conform to NEMA MG 1.

2.2.4 Filters: Air filters shall conform to CID A-A-1491 and shall be listed in accordance with the requirements of UL 900.

2.2.4.1 Filter Design: Sectional throwaway filters shall be 2 inches thick, and of size required to suit application. Air flow capacity of clean filters shall be based on net filter face velocity not exceeding 360 FPM with initial resistance of 0.12 inch water.

2.2.4.2 Holding Frames: Holding frames for sectional filters shall be fabricated from not lighter than 16-gauge sheet steel with rust-inhibitor coating. Each holding frame shall be gasketed. Where indicated or required, filter bank shall be erected, and all joints shall be gasketed and airtight.

2.2.5 Thermostats: Thermostats shall conform to UL 873, be compatible with the type of equipment being controlled, and the type and size which matches the thermostats being replaced.

2.3 FANS: V-belt drives shall be designed for not less than 120 percent of the connected driving capacity. Motor sheaves shall be variable pitch for 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 on delivery order. 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 on the plans.

Sound power level shall be as indicated on the plans. The sound power level values shall be obtained according to AMCA 300.

Standard AMCA arrangement, rotation, and discharge shall be as indicated on the plans.

2.3 CENTRIFUGAL FANS: Centrifugal fans shall be tested and rated in accordance with AMCA 210 and AMCA 300. 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 30 inches. Fan blades for wheels over 30 inches in diameter shall be backward-inclined or airfoil design. Fan wheels over 36 inches in diameter shall have overhung pulleys and a bearing on each side of the wheel. Fan wheels 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 Std 9 and ABEMA Std 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 1,800 rpm and shall have totally enclosed enclosures, and shall be provided with motor starters.

2.3.1 Ceiling Exhaust Fans, Commercial: 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.

2.3.2 In-Line Centrifugal Fans, Commercial: 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.

2.3.3 Power Roof Ventilators, Commercial: 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, dampers, and roof curb. Motors enclosure shall be dripproof type unless otherwise specified. Grease-laden kitchen exhaust fans shall be centrifugal type according to UL 705 and fitted with V-belt drive, round hood, and windband upblast discharge configuration, integral residue trough and collection device, motor and power transmission components located in outside positively air ventilated compartment. Lubricated bearings shall be provided.

2.5 ADJUSTABLE FREQUENCY DRIVES (AFD): All VAV air handlers shall be furnished with an AFD unless noted otherwise. The AFD shall be rated 208/3/60 and provide a microprocessor-based adjustment of three-phase motors. The controllers shall be rated as shown in the drawings. As a minimum the continuous full load output current of the drive shall be equal to 1.05 times the full load current of the equivalent motor horsepower as listed by National Electric Code Table 430-150, based on 40^{o}C ambient.

The AFDs shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation. All three phases of AC input power shall first pass through a minimum 5% impedance AC reactor before the converter section of each drive for enhanced transient suppression and harmonic mitigation. Internal drive filters used on the DC section, including DC chokes, DC reactors, or DC capacitors, shall not in any way meet this requirement. AC reactors (TCI series KLR or equivalent) shall be supplied on all drives without exception, shall be integral to the drive enclosure, and shall be "K" rated per IEEE C57-110. Input Displacement Power Factor (DPF) shall not be less than 0.95.

Door-mounted display shall be in English and display a minimum of two parameters and their values simultaneously. Displayed items shall include:

Speed in % (not RPM or Hz). Provide separate speed meter if speed and amps cannot be displayed simultaneously.
Green "RUN" light, in addition to English display of run speed.
Red "FAULT" light, in addition to English display of fault status.
"Start/Stop" pushbuttons, and "Faster/Slower" speed control pushbuttons.
Amber indicating lights for "Keypad" and "Remote" control status.
Speed setpoint.
Motor amps.
Motor volts, line volts, and DC bus volts.
Elapsed time to accumulate motor run hours.
kW, and resettable kWH accumulation.
Diagnostic display of all faults.

Insulated Gate Bipolar Transistors (IGBTs) shall be used in the inverter section. The AFDs shall be programmable on over-temperature to either fold back the switching frequency or fold back the speed, without shutdown, until the over-temperature condition has passed.

dV/dt filters (TCI series KLC or equivalent) and peak voltage limiters shall be installed inside each drive enclosure on the inverter output, regardless of motor conductor distance. They shall consist of a minimum 1.5% impedance reactor, in conjunction with a resistor/capacitor network, to form a damped low-pass filter. Use of output reactors alone is not acceptable.

The AFDs shall be able to start into a spinning motor. The AFDs shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the AFDs shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor in the preset method of starting.

Enclosure shall be NEMA 1.

Control Functions shall include:

Selectable (keypad, remote) start/stop control, switching between either the start and stop buttons on the keypad or a remote maintained contact closure.

Selectable (keypad, remote) speed control, switching between either the faster and slower buttons on the keypad or a remote analog (0-10 VDC, 4-20 mA, etc.) input.

Programmable minimum and maximum speed limits.

Programmable acceleration and deceleration times.

Programmable critical frequency avoidance lockout zones (5 each).

Programmable automatic restart after a power failure or fault.

External safety (freezestat, smoke detector, high pressure switch, vibration cutout switch, etc.) interlock to shut down the drive in any mode, and restart upon resetting of the safety.

Analog outputs (0-10 VDC, 4-20 mA, etc.) proportional to speed, motor amps, and kW.

Digital outputs to monitor drive run and fault status remotely.

The AFD shall include the following protective features:

Overcurrent protection.
Overvoltage protection.
Undervoltage protection.
Overfrequency protection.
Phase loss protection.
Over-temperature protection, with selectable foldback or trip.
Ground fault protection.
Adjustable current limit.
Line-to-line and line-to-ground output short circuit protection.
Overload capability shall be 110% for 60 seconds.

Diagnostic features shall include the following:

Fault history. Record and log faults in English language, most recent first, by date, time, item, and description of that item. Store up to 15 faults.

Warning history. Record and log the last 15 warnings by date, time, item, and description of that item.

Event history. Record and log the last 15 command events by date, time, command, and description of that command.

Trend files. Record 500 msec of trend data before each of the recorded faults. Display any four of eight parameters both digitally and in four color graphics via the windows based program.

Real time buffer. Select one of ten items to trigger input. Select four of thirteen tuning parameters to capture four of fifteen signals. The time base shall be adjustable from five to 60 msec.

I/O monitor. Provide a block monitor to aid in troubleshooting by showing I/O status.

Optional features to be included in AFDs:

A resettable high magnetic circuit protector (HMCP) shall be integral to the drive enclosure and door-interlocked. The HMCP shall protect against single-phasing in bypass, provide short circuit protection, have adjustable trip settings, an be resettable. Door operator shall include indication of OFF, ON, and TRIPPED status. Fused or non-fused disconnect switches are not acceptable.

Provide a manual bypass for redundant across-the-line operation. Bypass shall include two magnetic contactors, mechanically and electrically interlocked, for the inverter output and bypass. A third magnetic contactor shall be used on the inverter input to automatically isolate power from it during bypass operation (a manually operated service disconnect is NOT an acceptable substitute for the third contactor). Auxiliary contacts shall be provided for monitoring run status in both modes of operation (Inverter and Bypass). A control transformer, fused on both the primary and secondary, and Inverter/Off/Bypass selector switch shall be included. Any external safeties (freezestat, smoke detector, vibration cutout switch, high pressure switch, etc.) shall shut down the motor in all modes of operation. Resetting the permissive shall automatically restart the drive. A bimetallic thermal overload shall be included with heaters sized for the motor nameplate amps. Overload shall have dial-adjustable current trip settings for optimum motor protection without need to replace heater elements.

Seriel communications for monitoring and control of drive operation. An RS-485 port shall be provided with Johnson Controls N2 or Modbus protocol for direct connection to the Building Automation System or EMCS.

2.5.1 Field Quality Control: Provide the services of a qualified factory-trained technician to assist the Contractor in installation and start-up of the equipment specified under this section. The technician shall provide technical direction and assistance to the Contractor in general assembly of the equipment, connections and adjustments, and testing of the system. All costs for travel, time, meals, etc., required for the technician to perform these services shall be the responsibility of the drive supplier.

Factory-trained technician shall provide operator training on the operation, maintenance, and trouble-shooting of the system. This shall include the drives and any related control interfaces. Training shall be at a time suitable to the owner, independent of start-up.

2.6 AIR-CURTAIN UNITS: Air curtain units shall be provided with a weatherproof housing constructed of high impact plastic or minimum 18 gauge rigid welded steel. Fan wheels shall be backward curved, non-overloading, centrifugal type and accurately balanced statically and dynamically. Motors shall have totally enclosed fan cooled enclosures. Motor starters shall be remote manual type with weather-resistant enclosure actuated when the doorway served is open. The air curtains shall attain the air velocities specified within 2 seconds following activation. Air intake and discharge openings shall be protected by bird screens. Air curtain unit or a multiple unit installation shall be at least as wide as the opening to be protected. The air discharge openings shall be so designed and equipped as to permit outward adjustment of the discharge air. Adjustment and installation placement shall be according to the manufacturer's written recommendation. Directional controls on air curtains for service windows shall be designed to be easily cleanable or readily removable. Air curtains shall be designed to prevent the adjustment of the air velocities specified. The interior surfaces of the air curtain units shall be accessible for cleaning. Certified test data indicating that the fan will provide the air velocities required when fan is mounted as indicated shall be furnished. Air curtains designed as fly fans shall be provided where indicated. Air curtains designed for use in service entranceways shall develop an air curtain not less than 3 inches thick at the discharge nozzle. The air velocity shall be not less than 1,600 fpm across the entire entryway when measured 3 feet above the floor. Air curtains designed for use on customer entranceways shall develop an air curtain not less than 8 inches thick at the discharge opening. The velocity shall be not less than 600 fpm across the entire entryway when measured 3 feet above the floor. Recirculating type air curtains shall be equipped with readily removable filters, or the filters shall be designed for in-position cleaning. The air capture compartment shall be readily accessible and easily cleanable or designed for in-position cleaning. Air curtains designed for use on service windows shall develop an air curtain not less than 8 inches thick at the discharge opening. The air velocity shall be not less than 600 fpm across the entire opening of the service window measured 3 feet below the air discharge opening.

PART 3 EXECUTION

3.1 GENERAL: Install air handling equipment including air handling units with coils, centrifugal fans, axial fans, power ventilators, air curtain units, and radon mitigation systems as indicated on the plans and specified herein.

3.2 INSTALLATION: Install air handling equipment and components in accordance with the manufacturer’s written installation, operation, and maintenance instructions; NAPHCC-01; and the requirements herein. Installation of new air

handling equipment and related components shall include all incidental items necessary to make complete operational installations.

3.2.1 Equipment Insulation: Equipment insulating shall be supplied by the manufacturer or accomplished in accordance with SECTION 15250, THERMAL INSULATION FOR DOMESTIC WATER AND HVAC PIPING, EQUIPMENT, AND DUCTWORK.

3.2.2 Piping Connections: Make piping connections in accordance with ANSI B31.1; NFPA 54; NFPA 211; SECTION 15400, PLUMBING; SECTION 15488, NATURAL GAS PIPING; SECTION 15510, HYDRONIC PIPING; SECTION 15520, STEAM AND STEAM CONDENSATE PIPING; and SECTION 15530, REFRIGERANT PIPING.

3.2.3 Ductwork Connections: Make ductwork connections in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, NFPA 90A and 90B, and SECTION 15880, AIR DISTRIBUTION EQUIPMENT.

3.2.4 Electrical Supply Connections: Make electrical supply connections in accordance with NFPA 70 and SECTION 16050, ELECTRICAL.

3.3 TESTING, ADJUSTING, AND BALANCING: Furnish the necessary equipment, instruments, facilities, and technically qualified personnel to perform the following tests.

3.3.1 Operational Tests: Following installation of air handling equipment and ductwork perform operational tests to demonstrate satisfactory functioning and operating effectiveness. Utilize manufacturers' specifications as standards for the testing. Submit written test results to the Contracting Officer.

3.3.2 Testing, Adjusting, and Balancing: Following installation of air handling equipment and ductwork perform testing, adjusting, and balancing of the systems in accordance with SECTION 15990, TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Submit written test results to the Contracting Officer.

DIVISION 15 - MECHANICAL

SECTION 15880

AIR DISTRIBUTION EQUIPMENT

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation of air distribution equipment including air cleaning devices, ductwork, ductwork accessories, sound attenuators, air terminal units, and air outlets and inlets required in this contract.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 Air Diffusion Council (ADC) Test Code:

1062 R4	Certification, Rating, and Test Manual.

1.2.2 Air Movement and Control Association (AMCA) Standards:

210	Laboratory Methods of Testing Fans for Rating.
500	Louver/Damper/Shutter Test Methods.

1.2.3 American Society for Testing and Materials (ASTM) Publications:

A53/A53M	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
A167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
A525	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
A527/A527M	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
A528/A528M	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Drawing Quality.
C916	Adhesives for Duct Thermal Insulation.
C1071	Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
D1785	Poly(Vinyl Chloride) (PVC) Plastic Pipe.
D2466	Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings.
D2564	Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
E84	Surface Burning Characteristics of Building Materials.

F872 Filter Units, Air-Conditioning: Viscous-Impingement Type, Cleanable.

1.2.4 American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standards:

52.1 Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

70 Method of Testing for Rating the Performance of Air Outlets and Inlets.

1.2.5 Commercial Item Description (CID):

A-A-1419 Filter Element, Air Conditioning (Viscous-Impingement and Dry Types, Replaceable).

1.2.6 Institute Of Environmental Sciences (IES) Publication:

RP-CC-001.3 HEPA and ULPA Filters.

1.2.7 Manufacturers Standardization Society Of The Valve And Fittings Industry (MSS) Standards:

SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture.

SP-69 Pipe Hangers and Supports - Selection and Application.

1.2.8 National Fire Protection Association (NFPA) Standards:

90A Installation of Air Conditioning and Ventilating Systems.

90B Installation of Warm Air Heating and Air Conditioning Systems.

96 Ventilation Control and Fire Protection of Commercial Cooking Equipment.

1.2.9 North American Insulation Manufacturers Association (NAIMA):

NAIMA AH115 Fibrous Glass Duct Construction Standards.

1.2.10 Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Standards:

Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems.

HVAC Duct Construction Standards - Metal and Flexible.

HVAC Systems Testing, Adjusting and Balancing.

1.2.11 Underwriters Laboratories (UL) Publications:

181 Factory-Made Air Ducts and Connectors.

214 Tests for Flame-Propagation of Fabrics and Films.

555	Fire Dampers and Ceiling Dampers.
586	High-Efficiency, Particulate, Air Filter Units.
723	Test for Surface Burning Characteristics of Building Materials.
900	Test Performance of Air Filter Units.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.3 Shop Drawings: Submit shop drawings for proposed installation of new components and replacement of existing system components. Submit shop drawings for proposed additions and changes to HVAC systems.

1.3.4 As-Built Drawings: Submit as-built drawings for installation of new components and replacement of existing system components. Submit as-built drawings for additions and changes to HVAC systems.

1.3.5 Test Results: Submit test results for all testing required under this section.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 AIR CLEANING DEVICES:

2.2.2 Filters: Air filters shall be of the size and type as indicated by the equipment manufacturer unless otherwise specified. 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.

2.2.2.1 Extended Surface Pleated Panel Filters: Filters shall be 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 500 feet per minute shall not exceed 0.36 inches 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.

2.2.2.3 Sectional Cleanable Filters: Cleanable filters shall conform to ASTM F872, and shall be thickness indicated. Viscous adhesive shall be provided in 5 gallon containers in sufficient quantity for 12 cleaning operations and not less than one quart for each filter section. One washing and charging tank shall be provided for every 100 filter sections or fraction thereof. Each washing and charging unit shall consist of a tank and a drain rack mounted on

legs. Drain rack shall be provided with dividers and partitions to properly support the filters in the draining position. Initial pressure drop for clean filters shall not exceed the applicable values listed in ASTM F872.

2.2.2.8 Range and Griddle Hood Service: Filter shall be sectional, permanent, washable, all metallic media type, nominal 50 mm (2 inches) thick, with suitable metal frames, designed for extraction of grease from grease-laden air.

2.2.2.9 Disposable Unit Filters: Filters shall be of the fiberglass disposable type, 1 inch thick, conforming to CID A-A-1419. Filters in each unit shall be removable without the use of tools.

2.2.2.10 Holding Frames: Frames shall be fabricated from not lighter than 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.

2.2.2.11 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 3-7/8 inches in diameter, shall have white dials with black figures and graduations, and shall have a minimum range of 1 inch 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 5 foot minimum lengths of 1/4 inch diameter vinyl tubing, and all hardware and accessories for gauge mounting.

2.3 DUCTWORK:

2.3.1 Metal Ductwork: Concealed ducts, connectors and fittings shall be fabricated from galvanized steel conforming to ASTM A525, A527/A527M or A528/A528M unless otherwise specified. Ductwork connected to food service equipment shall be type 316 stainless steel with welded seams unless otherwise specified. The gauge of steel and fabrication of ducts, connectors and fittings shall conform to SMACNA HVAC Duct Construction Standards. Ductwork shall include elbows, tees, reducers, casing construction, access doors, hangers, anchors, supports, duct joints, volume dampers, duct connections, penetrations of casing, and casing curb details. Ducts shall conform accurately to the dimensions indicated, and be straight and smooth on the inside with joints neatly finished. Ducts shall be secured to the building structural slab or framing. Ducts shall be fabricated in such a manner that after installation there will be no vibration under operating conditions. Static pressure Class 1/2, 1, and 2 inch w.g. ductwork shall meet the requirements of Seal Class C. Class 3 through 10 inch shall meet the requirements of Seal Class A. 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 2 inch band 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.

2.3.1.1 Joints: Joints shall be as indicated in SMACNA HVAC Duct Construction Standards, and no dust marks from air leaks shall show at duct joints, or at connections to grilles, registers, and diffusers. Laps at the joints shall be made in the direction of air flow.

2.3.1.2 Transformation: Unless otherwise indicated, transformations for diverging and converging air flow shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees.

2.3.1.3 Elbows, Fittings, and Take-Offs: Square elbows, fittings, and branch take-offs shall be designed and constructed as specified in SMACNA HVAC Duct Construction Standards. Double thickness type turning vanes shall be provided for all square elbows.

2.3.1.4 Flexible Runouts: Flexible runouts from branches or mains to outlets shall be insulated factory-fabricated, flexible connectors complying with UL 181 and UL 214. Either field or factory applied vapor barrier shall be installed. Flexible runouts shall not exceed 10 feet in length.

2.3.1.5 Stiffeners: Stiffeners shall be fabricated and installed as specified in SMACNA HVAC Duct Construction Standards.

2.3.2 Nonmetal Ductwork: Nonmetal ductwork shall not be used.

2.3.3 Flexible Ductwork: Metallic type duct shall be single-ply galvanized steel or Type 316 stainless steel. Duct shall be of corrugated/interlocked, folded and knurled type seam construction, bendable without damage through 180 degrees with a throat radius equal to 1/2 duct diameter. Duct shall conform to UL 181 and shall be rated for positive or negative working pressure of 15 inches water gauge at 650 degrees F.

2.3.5 Flexible Duct Connectors:

2.3.5.1 General Service Duct Connectors: A flexible duct connector approximately 6 inches 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".

2.3.5.2 High Temperature Service Duct Connections: Material shall be approximately 3/32 inch thick, 35 to 40-ounce per square yardweight, plain weave fibrous glass cloth with, nickel/chrome wire reinforcement for service in excess of 1200 degrees F.

2.3.6 Ductwork Hangars and Supports: Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.4 DUCTWORK ACCESSORIES:

2.4.1 Splitters and Dampers: Splitters shall be operated by quadrant operators or 3/16-inch rod brought through the side of the duct with locking setscrew and bushing. Two rods are required on splitters over 8 inches. Dampers shall conform to SMACNA HVAC Duct Construction Standards and UL 555. Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be two gauges heavier than duct in which installed. The Contractor shall install volume dampers for all diffusers and splitters for all locations in the ducts requiring splitters.

2.4.2 Duct Access Doors and Test Holes: 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 HVAC Duct Construction Standards. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 15 x 18 inches, unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 24 x 24 inches or larger shall be provided with fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

2.4.3 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 Fire Resistance Directory. Fire dampers shall be curtain type with damper blades out of the air stream unless otherwise specified. 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 Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems and in manufacturer's instructions for fire dampers shall be followed.

2.4.4 Air Deflectors: Air deflectors shall be installed in all duct-mounted supply outlets, takeoff or extension collars to supply outlets, and tap-in-branch-takeoff connections. Air deflectors shall be factory fabricated, and factory or field-assembled units consisting of curved turning vanes or louver blades for uniform air distribution and change of direction with minimum turbulence and pressure loss. Where adjustable devices such as air deflectors or extractors are inaccessible, they shall be provided with means for adjustment and position lock external to the duct in which installed.

2.4.5 Control Dampers: Where shown on the project plans, control dampers will be provided by the DDC Equipment manufacturer. On variable air volume air handling units, control dampers will be provided with an integral airflow measuring station as specified in the DDC Equipment section. It shall the responsibility of this contractor to install the dampers provided by the DDC Equipment provider.

2.6 AIR TERMINAL UNITS: Variable air volume (VAV) terminal units shall be the type, size, and capacity indicated on the plans. Units shall be mounted in the ceiling or wall cavity and shall be suitable for single or dual duct system applications. Actuators and controls shall be as specified in paragraph TEMPERATURE CONTROLS. Unit enclosures shall be constructed of galvanized steel not lighter than 22 gauge or aluminum sheet not lighter than 18 gauge. Single or multiple discharge outlets shall be provided as required. Units with flow limiters are not acceptable. Unit air volume shall be factory preset and readily field adjustable without special tools. Reheat coils shall be provided where indicated on delivery order, or to match existing units being replaced. A flow chart shall be attached to each unit. Acoustic performance of the terminal units shall be based upon units tested according to ARI 880. Sound power level shall be as indicated. Acoustical lining shall be according to NFPA 90A.

2.6.2 Variable Volume, Single Duct: Variable volume, single duct, terminal units shall be provided with a calibrated air volume sensing device, air valve or damper, actuator, and accessory relays. Units shall control air volume to within plus or minus 5 percent of each air set point volume as determined by the thermostat with variations in inlet pressures from 3/4 to 6 inch water gauge. Internal resistance of units shall not exceed 0.4 inch water gauge at maximum flow range. External differential pressure taps separate from the control pressure taps shall be provided for air flow measurement with a 0 to 1 inch water gauge range.

2.6.6 Reheat Units:

2.6.6.1 Hot Water Coils: Hot-water coils shall be fin-and-tube type constructed of seamless copper tubes and copper or aluminum fins mechanically bonded or soldered to the tubes. Headers shall be constructed of cast iron, welded steel or copper. Casing and tube support sheets shall be 16 gauge, galvanized steel, formed to provide structural strength. Tubes shall be correctly circuited for proper water velocity without excessive pressure drop and they shall be drainable where required or indicated. At the factory, each coil shall be tested at not less than 250 psi air pressure and shall be suitable for 200 psi working pressure. Drainable coils shall be installed in the air handling units with a pitch of not less than 1/8 inch per foot of tube length toward the drain end. Coils shall conform to the provisions of ARI ANSI/ARI 410.

2.7 AIR OUTLETS AND INLETS:

2.7.1 General: Diffusers, registers, and grilles shall be factory-fabricated from steel, have a baked enamel finish on all surfaces, and be performance rated and certified in accordance with ADC 1062 R4 and/or ASHRAE 70. Diffusers, registers, and grilles shall be the type, size, and color indicated or which matches the items being replaced.

2.7.1.1 Fabrication: Diffusers, registers, and grilles shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 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.

2.7.1.2 Sound Ratings: Inlets and outlets shall be sound rated and certified in sound power level, dB referenced to 10 to the minus 12 watt, in octave bands 2 through 8. Diffusers, registers, and grilles in all functional areas shall be selected for sound power level in the (3rd) (4th) (5th) (6th) octave band for 20 dB for diffusers, 25 dB for registers, and 25 dB for grilles in the size and capacity of the units indicated. Diffusers and registers shall be provided with opposed blade volume damper with accessible key operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable.

2.7.2 Diffusers: Diffusers shall be of the square type, with adjustable air discharge pattern. Ceiling-mounted units shall be furnished with an anti-smudge device, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors of the type indicated. 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 not interfere with volume controller.

2.7.3 Intake and Relief Ventilators: Air vents, penthouses, and goosenecks shall be fabricated from galvanized steel sheets with galvanized structural shapes. Sheet metal thickness, reinforcement, and fabrication shall conform to SMACNA HVAC Duct Construction Standards. 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.

2.7.4 Louvers: Louvers shall be performance rated and certified in accordance with AMCA 500. Louvers shall include only those in exterior walls which are directly connected by duct work to air-handling equipment. Louver blades shall be fabricated from aluminum or galvanized steel sheets, and shall be provided with a frame of galvanized steel or aluminum structural shapes. Sheet metal thickness and fabrication shall conform to SMACNA HVAC Duct Construction Standards. 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. Louvers shall be provided with bird screens.

2.7.5 Registers and Grilles: Registers shall be two, three or four-way directional-control type as indicated, except that return 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 6 inches below the ceiling unless otherwise indicated. Return and exhaust registers shall be located 6 inches above the floor unless otherwise indicated. Directional control may be achieved by a grille face which can be rotated in four positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

2.8 DUCT SLEEVES AND FRAMED PREPARED OPENINGS:

2.8.1 Locations: Duct sleeves shall be installed for all-round ducts 15 inches in diameter or less passing through walls and ceilings. Round ducts larger than 15 inches in diameter and all square, oval, and rectangular ducts passing through walls and ceilings shall be installed through framed prepared openings. Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are required where grilles, registers and diffusers are installed at the opening.

2.8.2 Duct Sleeves: Duct sleeves shall be fabricated from 20-gauge galvanized steel. Where sleeves are installed in bearing walls or partitions, black steel pipe shall be used. Black steel pipe for wall sleeves shall conform to ASTM A53, Schedule 40. Sleeve shall provide 1-inch clearance between the duct and the sleeve.

2.8.3 Framed Prepared Openings: Framed prepared openings shall have 1-inch clearance between the duct and the opening. Framed prepared openings shall be fabricated from 20 gauge galvanized steel, unless otherwise indicated.

2.9 PLENUMS AND CASINGS FOR FIELD-FABRICATED UNITS: Unless otherwise indicated, the casing for a central built-up unit shall be fabricated and erected as shown in SMACNA HVAC Duct Construction Standards. Openings in the casing, such as for piping connections, shall be sealed and covered to prevent air leakage.

2.9.1 Drain Pan: A cooling coil drain pan with outlet shall be provided to collect condensation from the coil. Drain pan shall be fabricated of 18-gauge corrosion-resisting sheet steel conforming to ASTM A167, welded and stiffened.

2.9.2 Floor Drain: Floor drain shall be a minimum 2-inch drain with dome strainer. Water seal for the drain shall provide pressure at least 2-inch water gage greater than the maximum negative pressure in the casing.

2.9.3 Anchoring: Casing shall terminate at the floor line and be anchored by the use of galvanized angle iron. Angle iron shall be sealed and bolted to the floor or curb, as indicated in SMACNA HVAC Duct Construction Standards.

2.9.4 Fabrication: Details of construction, including joint sealing, not specifically covered, shall be as indicated in SMACNA HVAC Duct Construction Standards. The plenums and casings shall be constructed to withstand the specified internal pressure of the air distribution systems.

PART 3 EXECUTION

3.1 GENERAL: Install air distribution equipment including air cleaning devices, ductwork, ductwork accessories, sound attenuators, air terminal units, and air outlets and inlets as indicated on the plans and specified herein.

3.2 INSTALLATION: Install air distribution equipment and components in accordance with SMACNA HVAC Duct Construction Standards, NFPA 90A, NFPA 90B, any applicable manufacturer’s written installation instructions, and the requirements herein.

3.2.1 Access Panels: Panels shall be provided for all concealed valves, vents, controls, dampers, and items requiring inspection or maintenance. Access panels shall be of sufficient size and so located that the concealed items may be serviced and maintained or completely removed and replaced.

3.2.2 Connections: Flexible connectors and other components of the air distribution systems shall be mechanically fastened with at least three equally spaced drivescrews, and joints shall be sealed with sealing compound and duct tape. Pre-insulated flexible connectors and flexible duct shall be attached to other components in accordance with the latest printed instructions of the preinsulated flexible connector and flexible duct manufacturer to ensure a vapor tight joint.

3.2.3 Duct Test Holes: Duct test holes with patches or threaded plugs in ducts and plenums shall be provided where necessary for using pitot tubes for taking air measurements to balance the air systems. At each of these locations where ducts or plenums are insulated, extension shall be provided with plug fittings.

3.2.4 Packing: Space between the sleeve or framed prepared opening and the duct and the duct insulation shall be packed with mineral wool or other approved material.

3.2.5 Duct Supports: Duct supports for sheetmetal ductwork shall be not less than two 1-inch by 16-gauge galvanized strap-iron hangers spaced one on each side of the duct in accordance with SMACNA HVAC Duct Construction Standards. 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 and detailed. Where C-clamps are used, retainer clips shall be provided. Friction beam clamps indicated in SMACNA HVAC Duct Construction Standards will not be used.

3.2.6 Joints: Low-pressure rectangular duct joints between sections of duct and between duct and fittings shall be made with either gasketed flanged connection, welded flanged joints, or other joints recommended in SMACNA HVAC Duct Construction Standards, and be reinforced at the joints and between the joints as recommended. Joints and seams shall be made airtight using the sealants listed in the SMACNA HVAC Duct Construction Standards.

3.2.7 Kitchen Exhaust Ductwork: Installation of kitchen exhaust ducts shall conform to NFPA 96 and the following requirements.

3.2.7.1 Ducts Conveying Smoke and Grease Laden Vapors: Ducts conveying smoke and grease laden vapors shall conform to requirements of NFPA 96. Seams, joints, penetrations, and duct-to-hood collar connections shall have a liquid tight continuous external weld. Duct material shall be minimum 18 gauge, Type 304L or 316L, stainless steel.

3.2.7.2 Exposed Ductwork: Exposed ductwork shall be fabricated from minimum 18 gauge, Type 304L or 316L, stainless steel with continuously welded joints and seams. Ducts shall be pitched to drain at hoods and low points indicated. Surface finish shall match hoods.

3.2.7.3 Concealed Ducts Conveying Moisture Laden Air: Concealed ducts conveying moisture laden air shall be fabricated from minimum 18 gauge, Type 300 series, stainless steel. Joints shall be continuously welded, brazed, or soldered to be liquid tight. Duct shall be pitched to drain at points indicated. Transitions to other metals shall be liquid tight, companion angle bolted and gasketed.

3.2.8 Acoustical Duct Lining: Lining shall be applied in cut-to-size pieces attached to the interior of the duct with nonflammable fire resistant adhesive conforming to ASTM C916, Type I, NFPA 90A, UL 723, and ASTM E84. Top and bottom pieces shall lap the side pieces and shall be secured with welded pins, adhered clips of metal, nylon, or high impact plastic, and speed washers or welding cup-head pins installed according to SMACNA HVAC Duct Construction Standards. Welded pins, cup-head pins, or adhered clips shall not distort the duct, burn through, nor mar the finish or the surface of the duct. Pins and washers shall be flush with the surfaces of the duct liner and all breaks and punctures of the duct liner coating shall be sealed with the nonflammable, fire resistant adhesive. Exposed edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of the nonflammable, fire resistant adhesive, to prevent delamination of glass fibers. Duct liner may be applied to flat sheet metal prior to forming duct through the sheet metal brake. Lining at the top and bottom surfaces of the duct shall be additionally secured by welded pins or adhered clips as specified for cut-to-size pieces. Other methods indicated in SMACNA HVAC Duct Construction Standards to obtain proper installation of duct liners in sheet metal ducts, including adhesives and fasteners, will be acceptable.

3.2.9 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.

3.2.10 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 CAULKING AND SEALING.

3.3 TESTING, ADJUSTING, AND BALANCING: Furnish the necessary equipment, instruments, facilities, and technically qualified personnel to perform the following tests.

3.3.1 Operational Tests: Following installation of air distribution equipment and ductwork perform operational tests to demonstrate satisfactory functioning and operating effectiveness. Utilize manufacturers' specifications as standards for the testing. Submit written test results to the Contracting Officer.

3.3.2 Testing, Adjusting, and Balancing: Following installation of air distribution equipment and ductwork perform testing, adjusting, and balancing of the systems in accordance with SECTION 15990, TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Submit written test results to the Contracting Officer.

3.4 INSULATION: Insulate ductwork in accordance with SECTION 15250, THERMAL INSULATION FOR DOMESTIC WATER AND HVAC PIPING, EQUIPMENT AND DUCTWORK.

DIVISION 15 - MECHANICAL

SECTION 15971

DIRECT DIGITAL HVAC CONTROL SYSTEMS

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of direct digital HVAC control systems required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 Air Movement and Control Association (AMCA) Publication:

500	Test Methods for Louvers, Dampers and Shutters.

1.2.2 American National Standards Institute (ANSI) Standards:

B16.18	Cast Copper Alloy Solder Joint Pressure Fittings.
B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes.
C12.1	Code for Electricity Metering.
X3.64	Additional Controls for Use with American National Standard Code for Information Interchange.
X3.154	Office Machines and Supplies – Alphanumeric Machines-Keyboard Arrangement.

1.2.3 American Society for Testing and Materials (ASTM) Publications:

A269	Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
B32	Solder Metal.
B75	Seamless Copper Tube.
B88	Seamless Copper Water Tube.
D635	Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
D1693	Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
D2666	Polybutylene (PB) Plastic Tubing.

D2737 Polyethylene (PE) Plastic Tubing.

1.2.4 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Publication:

03 Handbook, Fundamentals I-P Edition.

1.2.5 American Society of Mechanical Engineers (ASME) Standards and Boiler and Pressure Vessel Codes (BPVC):

PTC 19.3 Instruments and Apparatus: Part 3 Temperature Measurement.

Section VIII Division 1 Pressure Vessels, Basic Coverage.

1.2.6 Code of Federal Regulations (CFR):

47 CFR 15 Radio Frequency Devices.

47 CFR 68 Connection of Terminal Equipment to the Telephone Network.

1.2.7 Institute of Electrical and Electronics Engineers (IEEE) Publications:

C62.41 Surge Voltages in Low-Voltage AC Power Circuits.

Std 142 IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems.

1.2.8 National Electrical Manufacturers Association (NEMA) Publications:

250 Enclosures for Electrical Equipment (1,000 Volts Maximum).

ICS 1 Industrial Controls and Systems.

1.2.9 National Fire Protection Association (NFPA) Publications:

70 National Electrical Code (NEC).

90A Installation of Air Conditioning and Ventilating Systems.

1.2.10 Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Publication:

07 HVAC Systems - Testing, Adjusting and Balancing.

1.2.11 Underwriters Laboratories (UL) Publications:

1 Flexible Metal Conduit.

3 Flexible Nonmetallic Tubing for Electric Wiring.

94 Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

514A	Metallic Outlet Boxes.
514B	Fittings for Conduit and Outlet Boxes.
651	Schedule 40 and 80 Rigid PVC Conduit.
651A	Type EB and A Rigid PVC Conduit and HDPE Conduit.
797	Electrical Metallic Tubing.
916	Energy Management Equipment.

1.3 SUBMITTALS:

1.3.1 Data:

1.3.1.1 Equipment Data: The equipment data shall be in booklet form, indexed to the unique identifiers, shall consist of data sheets that document compliance with the specification and shall include a copy of each HVAC control system bill of materials. Catalog cuts shall be in booklet form indexed by device type. Where multiple components are shown on a catalog cut, the application specific component shall be marked. Data shall include a list of qualified service organizations and their qualifications. Service organizations shall be reasonably convenient to the equipment on a regular and emergency basis, during the warranty period.

1.3.1.2 System Descriptions and Analyses: System descriptions, analyses, and calculations used in required sizing equipment. Descriptions and calculations shall show how the equipment will operate as a system to meet the specified performance. The data package shall include the following:

1.3.1.2.1 DDC panel memory size.

1.3.1.2.2 DDC panel automatic start up operations.

1.3.1.2.3 Database update procedure.

1.3.1.2.4 DDC panel expansion capability and method of implementation.

1.3.1.2.5 DDC panel operation.

1.3.1.2.6 Database entry forms or data listings.

1.3.1.3 Software: Descriptions of software, including the control algorithm for proportional-integral (PI) control and explanation as required.

1.3.1.4 System Overall Reliability Calculations: Manufacturer's reliability data and calculations required to show compliance with the specified reliability. Instrumentation and controls shall not be included in the calculations.

1.3.1.5 Training Data: A training course in the maintenance and operation of the HVAC control systems, approved 60 days prior to the start of training. Lesson plans and training manuals for the training, including type of training to be provided, with a list of reference material. The training shall be oriented to the specific systems being installed. One training manual shall

be furnished for each trainee, plus two additional copies for archival storage at the project site. The manuals shall include the agenda, the defined objectives for each lesson, and a detailed description of the subject matter for each lesson. Two copies of audiovisual materials shall be included, for archival storage at the project site, either as a part of the printed training manuals or on the same media as that to be used during the training session.

1.3.1.6 Data Entry Forms: The completed data entry forms or data summaries, if data entry is done through interactive computer interfacing, utilizing all data required by the contract documents and other pertinent information required for complete installation of the database. Additional data to provide a complete and operational control system shall be identified and requested from the Government. The proposed forms shall be provided at least 90 days prior to the Contractor's scheduled need date.

1.3.2 Drawings:

1.3.2.1 System Drawings: The system drawings shall include the following:

1.3.2.1.1 A drawing index.

1.3.2.1.2 A list of symbols.

1.3.2.1.3 A series of drawings for each HVAC control system using abbreviations, symbols, nomenclature and identifiers as shown on the contract drawings. Each control-system element on a drawing shall have a unique identifier as shown.

1.3.2.1.3.1 Each series of drawings for an HVAC control system shall include a schematic as shown on the contract drawings, a wiring diagram, a list of equipment with manufacturer and model number, a DDC panel arrangement drawing and an HVAC control-system sequence of operation. The sequence of operation for each HVAC control system shall be in the language and format of this specification. No operational deviations from specified sequences will be permitted without prior written approval of the Contracting Officer. The sequence of operation shall refer to each device by its unique identifier. Contractor shall place in all equipment cabinets or enclosures a set of 11″x17″ laminated blueprints for the HVAC system served.

1.3.2.1.3.2 The wiring diagram shall show the interconnection of wires and cables to DDC panel terminal blocks and to the identified terminals of starters and packaged equipment, with necessary jumpers and ground connections. The wiring diagram shall show the labels of all conductors. All sources of power required for HVAC control systems and for packaged equipment control systems shall be identified back to the panelboard circuit breaker number, DDC panel, magnetic starter, or packaged control equipment circuit. Each power supply and transformer not integral to a starter or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown.

1.3.2.1.4 A system block diagram.

1.3.2.1.5 DDC panel/DTC installation, block diagrams, and wiring diagrams.

1.3.2.1.6 DDC panel/DTC physical layout and schematics.

1.3.2.1.7 Details of surge protection device installations.

1.3.2.1.8 Valve schedules. The valve schedule shall include each valve's unique identifier, size, flow coefficient (Cv), pressure drop at specified flow rate, spring range, positive-positioner range, and actuator size, supported by close-off pressure data, dimensions, operation rate, and access and clearance requirements data.

1.3.2.1.9 Damper schedules. The damper schedule shall contain each damper's and each 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 multisection dampers, and methods of connecting dampers, actuators, and linkages. The damper schedule shall include the maximum expected velocity through the damper at the intended location and 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; and access and clearance requirements.

1.3.3 Statements:

1.3.3.1 Factory Testing: Six copies of the test procedures for the factory test. The test procedures shall explain in detail, step-by-step actions and expected results to demonstrate compliance with the specified requirements, and the methods for simulating the necessary conditions of operation to demonstrate performance of the system. Written approval by the Government of the factory test procedures shall be one of the prerequisites for scheduling the factory test.

1.3.3.2 Site Testing: Six copies of the test procedures for the site testing. The site testing procedures shall identify each item to be tested and shall clearly describe each test. The test procedures shall include a list of the test equipment to be used for site testing, manufacturer and model number, and the date of calibration and accuracy of calibration, within 6 months of the test date.

1.3.3.3 Performance Verification Testing and Endurance Testing: Six copies of the test procedures for the performance verification test and the endurance test. The test procedures shall explain in detail, step-by-step actions and expected results to demonstrate compliance with the specified requirements. Written approval by the Government of the performance verification test procedures shall be one of the prerequisites for commencing the performance verification test. Endurance testing is not required when Johnson Controls Metasys equipment is furnished and installed.

1.3.3.4 Commissioning Procedures: Commissioning procedures for each HVAC control system, and for each type of terminal unit control system. The procedures shall reflect the language and format of this specification. The commissioning procedures shall refer to the devices by their unique identifiers as shown and shall include step-by-step configuration procedures for each system. The configuration procedures shall include a configuration check sheet showing all configuration parameters. Six copies of Commissioning Procedures, in booklet form and indexed, for each system, 60 days prior to system commissioning. Commissioning procedures shall include general instructions on how to set control parameters including setpoints; proportional, integral, and derivative mode constants; contact output settings for the spe-

cific devices provided. Commissioning procedures shall be specific to each HVAC system, shall detail the steps involved, and shall refer to the procedures in the booklet for specific devices.

1.3.4 Reports:

1.3.4.1 Test Reports: Six copies of the site testing data. Original copies of data produced during site testing, including results of each test procedure, after approval of the site tests.

1.3.4.2 Performance Verification and Endurance Report: Six copies of the performance verification and endurance test report after completion of a successful test. Documentation of test results for the entire HVAC control system complete, in booklet form and indexed, within 30 days after each test. Endurance testing is not required when Johnson Controls Metasys equipment is furnished and installed.

1.3.4.3 Control System Calibration, Adjustments, and Commissioning: Six copies of the calibration, adjustment and commissioning report which shall include setpoints and proportional, integral and derivative mode constant settings, calibration data for instruments and controls, and all the data resulting from adjusting the control system devices and commissioning HVAC control system.

1.3.5 Operation and Maintenance Manuals:

1.3.5.1 Operation and Maintenance Manuals: The Group III Technical Data Package consisting of the operation and maintenance data in manual format. Final copies of the manuals bound in hardback, loose leaf binders, within 30 days after completing the endurance test. 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. Each manual's contents 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 draft copy used during site testing shall be updated with any changes required, prior to final submission of the manual. The final copies delivered after completion of the endurance test shall include modifications made during installation checkout and acceptance. Manuals shall include:

1.3.5.2 Functional Design Manual: Two copies of the functional design manual which shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes.

1.3.5.3 Hardware Manual: Two copies of the hardware manual which shall describe equipment furnished, including:

1.3.5.3.1 General description and specifications.

1.3.5.3.2 Installation and checkout procedures.

1.3.5.3.3 Equipment electrical schematics and layout drawings.

1.3.5.3.4 System schematics and I/O device wiring lists.

1.3.5.3.5 Alignment and calibration procedures.

1.3.5.3.6 Manufacturer's repair parts list indicating sources of supply.

1.3.5.4 Software Manual: Two copies of the software manual which shall describe the functions of all software, and shall include all other information necessary to enable proper loading, testing and operation including, but not limited to the following:

1.3.5.4.1 Definitions of terms and functions.

1.3.5.4.2 Operator commands.

1.3.5.4.3 System access requirements.

1.3.5.4.4 Data entry requirements.

1.3.5.4.5 Descriptions of application software.

1.3.5.4.6 Description of database structure and interface with programs.

1.3.5.4.7 Alarms.

1.3.5.5 Operator's Manual: Six complete copies of operation manuals for each HVAC control system, in booklet form and indexed, outlining the step-by-step procedures required for each HVAC control system's startup, operation, and shutdown. The manuals shall include detail drawings, equipment data, and manufacturer supplied operation manuals for all equipment.

1.3.5.6 Maintenance Manual: Six complete copies of maintenance manuals, indexed in booklet form listing maintenance procedures. The maintenance instructions shall include a maintenance check list for each HVAC control system. Maintenance manuals shall include spare parts data and recommended maintenance tool kits for all control devices. Maintenance instructions shall include recommended repair methods, either field repair, factory repair, or whole-item replacement. The manual shall contain a list of service organizations qualified to service the HVAC control system, including the service organization name and telephone number. If operation and maintenance manuals are provided in a common volume, they shall be clearly differentiated and separately indexed.

1.4 GENERAL REQUIREMENTS: The direct digital control (DDC) shall be a complete control system consisting of a building automation system and an automatic temperature control system suitable for the HVAC system. DDC shall be compatible with the existing Fort Riley EMCS automation system. DDC shall include Fort Riley LAN compatible communications cards for connection to the Fort Riley Local Area Network (LAN). Contractor shall supply all materials required and software generation necessary to enable the DDC to communicate with all the Fort Riley EMCS operator workstations (including M5 workstations), EMCS Laptop Workstations (utilized in the field), and the EMCS engineering control station located in building 364. Fort Riley personnel will supply the necessary LAN drops and IP addresses.

1.4.1 Nameplates, Lens Caps, and Tags: Nameplates and lens caps bearing legends as shown and tags bearing device-unique identifiers as shown shall have engraved or stamped characters. Nameplates shall be mechanically at-

tached to direct digital control (DDC) panel interior doors. A plastic or metal tag shall be mechanically attached directly to each device or attached by a metal chain or wire. This applies to all sensor enclosures/boxes, field hardware, cabinets, equipment enclosures. In the equipment enclosure mark the Application Specific Controllers (ASC) with lettered and numbered identifiers that match the prints. Place markers under or above relays for the equipment being controlled. Example: (Boiler 1-Blr-1), transducers such as Mixed air damper-MAD-1 etc. Not R-1, R-2 or EPT-1, EPT-2 etc. This way the technicians and/or mechanics do not have to go to a print for manual overrides of the HVAC equipment in emergencies. Please do the same for enclosures and equipment cabinets. Place the HVAC equipment name being served on the cabinet not just an enclosure or cabinet number.

1.4.2 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.

1.4.3 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.

1.4.4 Power-Line Surge Protection: Equipment connected to ac circuits shall be protected from power-line surges. Equipment protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

1.4.5 Surge Protection for Transmitter and Control Wiring: DDC 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:

1.4.5.1 A 10 microsecond by 1,000 microsecond waveform with a peak voltage of 1,500 volts and a peak current of 60 amperes.

1.4.5.2 An 8 microsecond by 20 microsecond waveform with a peak voltage of 1,000 volts and a peak current of 500 amperes.

1.4.6 Power-Line Conditioners (PLC): PLCs shall be furnished for each DDC 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:

1.4.6.1 At 85 percent load, the output voltage shall not deviate by more than plus or minus 1 percent of nominal when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.

1.4.6.2 During load changes of zero to full load, the output voltage shall not deviate by more than plus or minus 3 percent of nominal. Full correction of load switching disturbances shall be accomplished within 5 cycles, and 95 percent correction shall be accomplished within two cycles of the onset of the disturbance.

1.4.6.3 Total harmonic distortion shall not exceed 3-1/2 percent at full load.

1.4.7 System Overall Reliability Requirement: The system shall be configured and installed to yield a mean time between failure (MTBF) of at least 40,000 hours. Each DDC panel shall be designed, configured, installed and programmed to provide for stand alone operation with minimal performance degradation on failure of other system components to which it is connected or with which it communicates.

1.4.8 Multiple DDC Panel Requirement: Where the system to be controlled by the DDC system is located in multiple mechanical rooms, each mechanical room shall have at least one DDC panel. DDC panels shall not control equipment located in a different mechanical room. DDC panels shall be located in the same room as the equipment being controlled or in an adjacent space which has direct access to the equipment room.

1.4.9 System Accuracy and Display: The system shall maintain an end-to-end accuracy for 1 year from sensor to operator's console display for the applications specified and shall display the value as specified. Each temperature shall be displayed and printed to nearest 0.1 degree F.

1.4.9.1 Space Temperature: Space temperature with a range of 50 to 85 degrees F. plus or minus 0.75 degree F. for conditioned space; 30 to 130 degrees F. plus or minus 1 degree F. for unconditioned space.

1.4.9.2 Duct Temperature: Duct temperature with a range of 40 to 140 degrees F. plus or minus 2 degrees F.

1.4.9.3 Outside Air Temperature: Outside air (OA) temperature with a range of minus 30 to plus 130 degrees F. plus or minus 2 degrees F.; with a subrange of 30 to 100 degrees F. plus or minus 1 degree F.

1.4.9.4 Water Temperature: Water temperature with a range of 30 to 100 degrees F. plus or minus 0.75 degree F; the range of 100 to 250 degrees F. plus or minus 2 degrees F; and water temperatures for the purpose of performing Btu calculations using differential temperatures to plus or minus 0.5 degrees F. using matched sensors.

1.4.9.5 Pressure: Pressure with a range for the specific application plus or minus 2.0 percent of range display and print to nearest 0.1 inch water column.

1.4.9.6 kWh and kW Demand: kWh and kW demand with a range for the specific application plus or minus 1.0 percent of reading (display and print to nearest kWh or kW).

1.4.9.7 Analog Value Input: An analog value input to the system's equipment via an AI with a maximum error of 0.50 percent of range, not including the sensor or transmitter error. This accuracy shall be maintained over the specified environmental conditions.

1.5 TESTING:

1.5.1 Factory Test: The Contractor shall assemble the factory test DDC system as specified and perform test to demonstrate that the performance of the system satisfies the requirements of this specification. Model numbers of

equipment tested shall be identical to those to be delivered to the site. Original copies of all data produced, including results of each test procedure during factory testing shall be delivered to the Government at the conclusion of testing, prior to Government approval of the test. The test results documentation shall be arranged so that commands, responses, and data acquired are correlated in a manner which will allow for logical interpretation of the data. The factory test setup shall include the following:

1.5.1.1 Command Entry Device with Keyboard.

1.5.1.2 Printer.

1.5.1.3 Disk Storage.

1.5.1.4 DDC Panel.

1.5.1.5 DDC Panel Test Set.

1.5.1.6 DDC Panel Portable Tester.

1.5.1.7 VAV Box Controller.

1.5.1.8 VAV Box Communication and Programming Device.

1.5.1.9 Communication links of each type and speed including Modems.

1.5.1.10 Dial-up Modem.

1.5.1.11 Software.

1.5.2 Site Testing: Personnel, equipment, instrumentation, and supplies shall be provided as necessary to perform site testing, adjusting, calibration and commissioning. Wiring shall be tested for continuity and for ground, open, and short circuits. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. Written Government approval of the specific site testing procedures shall be obtained prior to any test. Written notification of any planned site testing, commissioning or tuning shall be given at least 14 calendar days prior to any test.

1.5.3 Control System Calibration, Adjustments, and Commissioning: Instrumentation and controls shall be calibrated and the specified accuracy shall be verified using test equipment with calibration traceable to NIST standards. Mechanical control devices shall be adjusted to operate as specified. Control parameters and logic (virtual) points including control loop setpoints, gain constants, and integral constraints, shall be adjusted before the system is placed on line. Communications requirements shall be as indicated. Control system commissioning shall be performed for each HVAC system. The report describing results of functional tests, diagnostics, and calibrations, including written certification, shall state that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.

1.5.4 Performance Verification Test: Compliance of the HVAC control system with the contract documents shall be demonstrated. Using test plans and procedures previously approved, physical and functional requirements of the project, including communication requirements shall be demonstrated. The per-

formance verification test procedures shall explain, step-by-step, the actions and expected results that will demonstrate that the control systems perform in accordance with the sequences of operation. The performance verification test shall not be started until after receipt of written permission by the Government, based on the Contractor's written certification of successful completion of site testing and training.

1.5.5 Endurance Test: The endurance test shall be used to demonstrate the specified overall system reliability requirement of the completed system. The endurance test shall not be started until the Government notifies the Contractor in writing that the performance verification test is satisfactorily completed. The Government may terminate the testing at any time when the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, the Contractor shall commence an assessment period as described for Phase II. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation as specified to the Government prior to acceptance of the system. Endurance testing is not required when Johnson Controls Metasys equipment is furnished and installed.

1.5.5.1 Phase I (Testing): The test shall be conducted 24 hours per day, 7 days per week, for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized by the Government in writing.

1.5.5.2 Phase II (Assessment): After the conclusion of Phase I, the Contractor shall identify failures, determine causes of failures, repair failures, and deliver a written report to the Government. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which testing should be resumed. After delivering the written report, the Contractor shall convene a test review meeting at the jobsite to present the results and recommendations to the Government. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by performing appropriate portions of the performance verification test. Based on the Contractor's report and test review meeting, the Government may require that the Phase I test be totally or partially rerun. After the conclusion of any retesting which the Government may require, the Phase II assessment shall be repeated as if Phase I had just been completed.

1.5.6 Coordination with HVAC System Balancing: The HVAC control system shall be tuned after all air-system and hydronic-system balancing has been completed, minimum damper positions set and a report issued. Commissioning may be performed prior to or simultaneous with HVAC system balancing.

1.5.7 Posted Instructions: Instructions on letter-size sheets and half-size plastic laminated drawings for each system, showing the final installed conditions, shall be placed in each HVAC control panel. The posted instructions shall include the control sequence, control schematic, ladder diagram, wiring diagram, valve schedules, damper schedules, commissioning procedures, and preventive maintenance instructions.

1.6 TRAINING:

1.6.1 General: The training course shall be conducted for operating staff members designated by the Contracting Officer in the maintenance and operation of the system, including specified hardware and software. A training

day is defined as 8 hours of classroom instruction, including breaks and lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. For guidance in planning the required instruction, the Contractor shall assume that the attendees will have a high school education or equivalent, and are familiar with HVAC systems. No training shall be scheduled until training manuals and O&M manuals have been approved by the Government.

1.6.2 Training Course Content: The course shall be taught at the project site for a period of 2 training days. The training course shall cover all 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.

1.7 MAINTENANCE AND SERVICE:

1.7.1 General Requirements: Services, materials and equipment shall be provided as necessary to maintain the entire system in an operational state as specified for a period of 1 year after successful completion and acceptance of the Performance Verification Test. Impacts on facility operations shall be minimized.

1.7.2 Description of Work: The adjustment and repair of the system shall include the manufacturer's required adjustments of computer equipment, software updates, transmission equipment and instrumentation and control devices.

1.7.3 Personnel: Service personnel shall be qualified to accomplish work promptly and satisfactorily. The Government shall be advised in writing of the name of the designated service representative, and of any changes in personnel.

1.7.4 Scheduled Inspections: Two inspections shall be performed at 6 month intervals (or less if required by the manufacturer), and all work required shall be performed. Inspections shall be scheduled in June and December. These inspections shall include:

1.7.4.1 Visual checks and operational tests of all equipment.

1.7.4.2 Fan checks and filter changes for all control system equipment.

1.7.4.3 Clean all control system equipment including interior and exterior surfaces.

1.7.4.4 Check and calibrate each field device. Check and calibrate 50 percent of the total analog points during the first inspection. Check and calibrate the remaining 50 percent of the analog points during the second major inspection. Certify analog test instrumentation accuracy to be twice that of the device being calibrated. Randomly check at least 25 percent of all digital points for proper operation during the first inspection. Randomly check

at least 25 percent of the remaining digital points during the second inspection.

1.7.4.5 Run all system software diagnostics and correct all diagnosed problems.

1.7.4.6 Resolve any previous outstanding problems.

1.7.5 Scheduled Work: This work shall be performed during regular working hours, Monday through Friday, excluding legal holidays.

1.7.6 Emergency Service: The Government will initiate service calls when the system is not functioning properly. Qualified personnel shall be available to provide service to the system. A telephone number where the service supervisor can be reached at all times shall be provided. Service personnel shall be at the site within 4 hours after receiving a request for service. The control system shall be restored to proper operating condition within "1 calendar day" or 8 hours after receiving a request for service.

1.7.7 Operation: Scheduled adjustments and repairs shall include verification of the control system operation as demonstrated by the applicable tests of the performance verification test.

1.7.8 Records and Logs: Dated records and logs shall be kept of each task, with cumulative records for each major component, and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain all initial analog span and zero calibration values and all digital points. Complete logs shall be kept and shall be available for inspection onsite, demonstrating that planned and systematic adjustments and repairs have been accomplished for the control system.

1.7.9 Work Requests: Each service call request shall be recorded as received and shall include the serial number identifying the component involved, its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion. A record of the work performed shall be submitted within 5 days after work is accomplished.

1.7.10 System Modifications: Recommendations for system modification shall be submitted in writing. System modifications, including operating parameters and control settings, shall not be made without prior approval of the Government. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

1.7.11 Software: Updates to the software shall be provided for system; operating and application software shall be updated and operation in the system shall be verified. Updates shall be incorporated into operations and maintenance manuals, and software documentation. There shall be at least one scheduled update near the end of the first year's warranty period, at which time the latest released version of the Contractor's software shall be installed and validated on all Fort Riley EMCS workstations (including M5 workstations) and EMCS laptop workstations (utilized in the field).

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms with the requirements specified.

2.2 SYSTEM DESCRIPTION AND GENERAL EQUIPMENT REQUIREMENTS:

2.2.1 System Description: The HVAC control and monitoring system shall employ direct digital control. Control and monitoring system shall be designed, programmed, and installed by engineers and field personnel directly employed by the controls contractor. The system shall be programmed to obtain the sequence of operation and energy management functions as indicated. The direct digital control system shall be connected to the existing Johnson Controls Metasys System (UMCS) at Fort Riley that has been accepted as an approved interface by the Contracting Officer. The direct digital controls shall be Johnson Controls Metasys. All controls added under this project shall be connected to a global network control unit (NCU) located in the building, and shall communicate to the basewide UMCS via the LAN serving the base. Temperature control equipment, including panels, temperature sensors, and automatic dampers, but not including tubing, fittings, wire, conduit, non-automatic valves, and other standard marketed apparatus, shall bear the nameplate of the manufacturer. All engineering design required to install a high quality direct digital control and monitoring system capable of meeting the operating requirements and sequence of operation indicated on the plans and specified herein, shall be performed by the contractor. Contractor shall ensure that all equipment to be supplied is properly sized and is capable of handling the specified load.

2.2.2 General Equipment Requirements: Units of the same type of equipment shall be products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. 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 a satisfactory commercial or industrial use for 2 years prior to use on this project. The 2 years use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall 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 6,000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization. Items of the same type and purpose shall be identical, including equipment, assemblies, parts and components. Automatic temperature controls shall be direct digital controls that will provide the required sequence of operation.

2.2.2.1 Electrical and Electronic Devices: Electrical and electronic devices not located within an HVAC control panel shall have a NEMA ICS 1 enclosure in accordance with NEMA 250 unless otherwise shown.

2.2.2.2 Standard Signals: All analog outputs shall output a signal within the range of 0-to-5 VDC, 0-to-10 VDC or 4-20 MA. All analog inputs shall be within a range of 0-to-5 VDC, 0-to-10 VDC, or 4-to-20 MA, depending on the application. The signals shall originate from current-sourcing devices and shall be received by current-sinking devices.

2.2.2.3 Ambient Temperature Limits: DDC panels shall have ambient condition ratings of plus 35 to 120 degrees F. and 10 to 95 percent relative humidity, noncondensing. Devices installed outdoors shall operate within limit ratings of minus 35 to 150 degrees F. Instrumentation and control elements shall be rated for continuous operation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally encountered for the installed location.

2.3 CONDUIT, BOXES, AND FITTINGS:

2.3.1 Conduit: Conduit shall be electrical metallic tubing conforming to UL 797, Schedule 40 rigid PVC conduit conforming to UL 651, Type EB and A rigid PVC conduit and HDPE conduit conforming to UL 651A, flexible metal conduit conforming to UL 1, and flexible nonmetallic tubing conforming to UL 3.

2.3.2 Boxes: Boxes shall be metallic and conform to UL 514A.

2.3.3 Fittings: Fittings for conduit and outlet boxes shall conform to UL 514B.

2.4 CABLE, WIRING, AND TERMINAL BLOCKS:

2.4.1 Instrumentation Cable: Instrumentation cable shall be 18 AWG, stranded copper, single- or multiple-twisted, minimum 2 inch lay 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.

2.4.2 Digital Functions: Control wiring for digital functions shall be 18 AWG minimum with 600-volt insulation. Multiconductor wire shall have an outer jacket of polyvinyl chloride (PVC).

2.4.3 Analog Functions: Control wiring for analog functions shall be 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.

2.4.4 Sensor Wiring: Sensor wiring shall be 20 AWG minimum twisted and shielded, two-, three-, or four-wire to match analog function hardware. Multiconductor wire shall have an outer jacket of PVC.

2.4.5 Class 2 Low Energy Conductors: The conductor sizes specified for digital and analog functions shall take precedence over any requirements for Class 2 low energy remote-controlled and signal-circuit conductors specified elsewhere.

2.4.6 Control Wiring for 24-Volt Circuits: Control wiring for 24-volt circuits shall be 18 AWG minimum and shall be rated for 300-volt service.

2.4.7 Wiring for 120-Volt Circuits: Wiring for 120-volt circuits shall be 14 AWG minimum and shall be rated for 600-volt service.

2.4.8 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.

2.5 ACTUATORS:

2.5.1 General Requirements: Actuators shall be pneumatic for air handling unit control valves and control dampers and electric or electronic for VAV terminal unit valves and dampers. Actuators shall fail to their spring-return positions on signal or power failure and shall have a visible position indicator. Actuators shall open or close the devices to which they are applied within 60 seconds after a full scale input signal change. Electric or electronic actuators operating in parallel or in sequence shall have an auxiliary actuator driver. Pneumatic actuators shall have non-ferrous bellows or diaphragm of neoprene or other elastomer. Bellows or diaphragm shall be of sufficient size so that a change in operating pressure of not more than 2 percent of the total motor operating will be required to start the valve or damper moving.

2.5.2 Damper Actuators: The actuators shall be provided with mounting and connecting hardware. Actuators shall smoothly operate the devices to which they are applied. Actuators shall fully open and close the devices to which they are applied and shall have a full stroke response time of 60 seconds or less. The actuator stroke shall be limited by an adjustable stop in the direction of power stroke.

2.5.3 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.

2.5.4 Positive Positioners: Positive positioners are required for pneumatic actuators. Each positive positioner shall be a pneumatic relay with a mechanical feedback mechanism and an adjustable operating range and starting point.

2.6 AUTOMATIC CONTROL VALVES: Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Valve bodies shall be designed for not less than 125 psig working pressure or 150 percent of the system operating pressure, whichever is greater. Valve leakage rating shall be 0.01 percent of rated Cv. Unless otherwise specified, bodies for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends; bodies for 2 inch valves shall have threaded ends; and bodies for valves 2 to 3 inches shall be of brass, bronze or iron. Bodies for valves 2-1/2 inches and larger shall be provided with flanged-end connections.

2.6.1 Butterfly-Valve Assembly: Butterfly valves shall be threaded lug type suitable for dead-end service and 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 20 to 250 degrees F. Valves shall have a manual means of operation independent of the actuator.

2.6.2 Two-Way Valves: Two-way modulating valves shall have equal-percentage characteristics.

2.6.3 Three-Way Valves: Three-way valves shall provide linear flow control with constant total flow throughout full plug travel.

2.6.4 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.

2.6.5 Valves for Chilled Water, Service: Internal valve trim shall be bronze except that valve stems may be type 316 stainless steel. Valves 4 inches and larger shall be butterfly.

2.6.6 Valves for Hot Water Service: For hot water service below 250 degrees F. internal trim (including seats, seat rings, modulating plugs, and springs) of valves controlling water hotter than 210 degrees F. shall be Type 316 stainless steel. Internal trim for valves controlling water 210 degrees F. or less shall be brass or bronze. Nonmetallic parts of hot-water control valves shall be suitable for a minimum continuous operating temperature shall be suitable for a minimum continuous operating temperature of 250 degrees F. or 50 degrees F. above the system design temperature, whichever is higher. Valves 4 inches and larger shall be butterfly valves.

2.6.7 Maximum Pressure Drop Through Valve: Modulating water flow valve pressure drop shall be greater of 10 feet of water or 50 percent of the pressure drop through the device.

2.7 CONTROLLERS: Controllers shall be direct digital, field programmable, microprocessor based units with energy management functions that provide local display capability via an existing network terminal or existing laptop workstation. Digital system controller shall perform its assigned control and energy management functions as a stand-alone unit. The digital system controller shall be UL approved and listed as a signal system. The digital system controller shall perform its full control and energy management functions, regardless of condition of communications link with the energy management system.

2.8 DAMPERS:

2.8.1 Damper Assembly: A single damper section shall have blades no longer than 48 inches and shall be no higher than 72 inches. Maximum damper blade width shall be 8 inches. 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. Blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section shall not be located directly in the air stream. Damper axles shall be 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 0.04 inch water gauge at 1,000 feet per minute) in the wide-open position. Frames shall not be less than 2 inches in width. Dampers shall be tested in accordance with AMCA 500.

2.8.2 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.

2.8.3 Damper Types: Dampers shall be parallel blade type.

2.8.3.1 Outside Air, Return Air, and Relief Air Dampers: Outside air, return air and relief air 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 20 cfm per square foot at 4 inches water gauge static pressure when closed. Seals shall be suitable for an operating temperature range of minus 40 degrees F. to 200 degrees F. Dampers shall be rated at not less than 2,000 feet per minute air velocity.

2.8.3.2 Outside Air Dampers with Integral Airflow Stations: Where shown on the project plans and control drawings, outside air dampers shall be provided as described in the above paragraph but shall contain an integral airflow measuring station. These units shall be provided on variable air volume air handlers and shall allow the dampers to be positioned as required to maintain a constant quantity of outdoor air into the VAV system under varying conditions. The airflow station shall measure air flow by sensing pulse type electronic output signals which are directly proportional and linear to the airflow velocity. Each unit shall consist of single or multiple sensor probes which are inserted in the airflow to be measured. The measured accuracy shall be within + or - 3% of the full scale throughout the velocity range of 350 to 6000+ fpm. The digital output signals from the airflow sensing probes are totalized in a companion transmitter which produces a 4-20 milliamp output signal which is linear and proportional to airflow.

2.9 INSTRUMENTATION:

2.9.1 Measurements: Each transmitter shall have offset and span adjustments. Transmitters shall be calibrated to provide the following measurements, over the indicated ranges, for a linear output of 0-to-5 VDC, 0-to-10 VDC and 4-20 mA where applicable:

2.9.1.1 Conditioned space temperature, from 50 to 85 degrees F.

2.9.1.2 Duct temperature, from 40 to 140 degrees F. except that return air temperature for economizer operation shall be minus 30 to plus 130 degrees F.

2.9.1.3 Chilled water temperature, from 30 to 100 degrees F.

2.9.1.4 Heating hot water temperature, from 100 to 250 degrees F.

2.9.1.5 Outside air temperature, from minus 30 to plus 130 degrees F.

2.9.1.6 Differential pressure for VAV supply duct static pressure from 0 to 2.0 inches water gauge.

2.9.1.7 Pitot tube air flow measurement station and transmitter, from 0 to 0.1 inch water gauge for flow velocities of 500 to 1,200 fpm; 0 to 0.25 inch water gauge for velocities of 500 to 1,800 fpm; or 0 to 0.5 inch water gauge for velocities of 500 to 2,500 fpm.

2.9.1.8 Electronic air flow measurement station and transmitter, from 125 to 2,500 fpm.

2.9.2 Temperature Instruments:

2.9.2.1 Resistance Temperature Detectors (RTD): Each RTD shall be two-wire 1000 ohm platinum with a tolerance of plus or minus 0.1 percent at 0 degrees F., and shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper. Only 2-wire 1000 ohm platinum RTD's shall be utilized in temperature sensing applications unless excessive cable length is a factor.

2.9.2.2 Continuous Averaging RTD: Continuous averaging RTDs shall have a tolerance of plus or minus 1.0 degree F. 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 to match the resistance range of the averaging RTD.

2.9.3 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 or 3 wire device. The transmitter shall produce a linear 0-to-5 VDC, 0-to-10 VDC or 4-20 mA where applicable, output corresponding to the required pressure measurement. 4-20 mA devices shall be loop powered.

2.9.4 Thermowells: Thermowells shall be Series 300 stainless steel with threaded brass plug and chain, 2 inch lagging neck and extension type well. Inside diameter and insertion length shall be as required for the application.

2.9.5 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.

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. Range shall be 5.0 to 6.0 inches water gauge. Differential shall be a maximum of 0.15 inch water gauge at the low end of the range and 0.35 inch water gauge at the high end of the range.

2.11 RELAYS: Control relay contacts shall have utilization category and ratings selected for the application, with a minimum of two sets of contacts (two normally open, two normally closed) enclosed in a dustproof enclosure. Relays shall be rated for a minimum life of one million operations. Operating time hall be 20 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated

coil voltage. Time delay relays shall be 2 PDT with 8-pin connectors, dust cover, and a matching rail mounted socket. Adjustable timing range shall be 0 to 3 minutes. Power consumption shall not be greater than 3 watts.

2.12 CURRENT SENSING RELAYS: Current sensing relays shall provide a normally open contact rated at a minimum of 50 volts peak and 0.5 ampere or 25 VA, noninductive. There shall be a single hole for passage of current carrying conductors. The devices shall be sized for operation at 50 percent rated current based on the connected load. Voltage isolation shall be a minimum of 600 Volts.

2.13 SMOKE DETECTORS: Smoke detectors shall be as specified in SECTION 16721, ADDRESSABLE FIRE DETECTION AND ALARM SYSTEM.

2.14 THERMOSTATS:

2.14.1 General: Thermostat ranges shall be selected so that the setpoint is adjustable without tools between plus or minus 10 degrees F. of the setpoint. Thermostats shall be electric or low-voltage electronic.

2.14.2 Nonmodulating Room Thermostats: Contacts shall be single-pole double-throw (SPDT), hermetically sealed, and wired to identified terminals. Maximum differential shall be 5 degrees F. Room thermostats shall be enclosed with separate locking covers (guards).

2.14.3 Room Temperature Sensors: Room sensors shall be constructed for either surface or wall box mounting. Room sensors shall have the following options:

2.14.3.1 Setpoint reset slide switch providing a +/- 3 degree (adjustable)range.

2.14.3.2 Individual heating/cooling setpoint slide switches for heating and cooling systems.

2.14.3.3 Analog thermometer.

2.14.4 Nonmodulating Capillary Thermostats and Aquastats: Each thermostat shall have a capillary length of at least 5 feet, shall have adjustable direct reading scales for both setpoint and differential, and shall have a differential adjustable from 6 to 16 degrees F. Aquastats shall be of the strap-on type, with 10 degrees F. fixed differential.

2.14.5 Freezestats: Freezestats shall be manual reset, low temperature safety thermostats, with NO and NC contacts and a 20 foot element which shall respond to the coldest 18 inch segment.

2.15.1 CURRENT TO PNEUMATIC (IP) TRANSDUCERS: The transducers shall be two-wire-current-to-pressure transmitter that converts a 0-to-10 VDC input signal to 21-to-103 KPA (3-to-15 psig), or a 103-to-21 KPA (15-to-3 psig), pneumatic output, with a conversion accuracy of plus or minus two percent of full scale, including linearity and hysteresis. Input impedance shall not exceed 250 ohms. Air consumption shall not be greater than 0.12 L/s.

2.16 WATT-HOUR TRANSDUCERS: Watt-hour transducers shall have an accuracy of plus or minus 0.25 percent of full scale for kW and kWh outputs from full lag to full lead power factor. Input ranges for kW and kWh transducers shall be

selectable without requiring the changing of current or potential transformers. The output shall be 4-to-20 mAdc.

2.17 FIELD HARDWARE:

2.17.1 Direct Digital Control (DDC) Panel Hardware: DDC panels shall be microcomputer based with sufficient memory to perform specified DDC panel functions and operations. The panel shall not be dependent on logic or data from an external computer. The panel shall contain necessary I/O functions to connect to field sensors and control devices.

2.17.1.1 DDC Panel Features: The DDC panel shall include:

2.17.1.1.1 Main power switch.

2.17.1.1.2 Power on indicator.

2.17.1.1.3 Portable tester connector.

2.17.1.1.4 On-Off-Auto switches for each digital output. The status of these switches will be available to the DDC panel for further processing.

2.17.1.1.5 Minimum-Maximum-Auto switches, or Auto-Manual switches with manual potentiometer, for each analog output. The status of these switches will be available to the DDC panel for further processing.

2.17.1.2 Sealed Battery Backup: A sealed battery backup for the DDC panel memory and real time clock function sufficient to maintain them for a minimum period of 8 hours shall be provided. Automatic charging of batteries shall be provided, or alternately, lithium batteries sized to provide a minimum of 30 days operation and a shelf life of 2 years shall be provided. A low battery alarm with indication for each DDC panel shall be provided. Alternatively, capacitors may be provided to maintain memory and clock function for a minimum of 8 hours.

2.17.1.3 Electrical Service Outlet for use with Test Equipment: A single phase, 120 Vac electrical service outlet for use with test equipment shall be furnished either inside or within 6 feet of he DDC panel enclosure.

2.17.1.4 Locking Type Mounting Cabinets: Locking type mounting cabinets, with common keying and door switch wired to and DDC panel input for intrusion alarm annunciation, shall be furnished.

2.17.1.5 Failure Mode: Upon failure of the DDC panel, all connected points shall be forced to the failure mode shown in the I/O summary tables.

2.17.1.6 Portable Tester: Provisions for connection of a portable tester shall be furnished at each DDC panel location.

2.17.1.7 I/O Functions: I/O functions shall be provided as part of the DDC panel and shall be in accordance with the following:

2.17.1.7.1 The Analog Input (AI) function shall monitor each analog input, perform A-to-D conversion, and hold the digital value in a buffer for interrogation. The A-to-D conversion shall have a minimum resolution of 10 bits plus sign. Signal conditioning shall be provided for each analog input. Analog inputs shall be individually calibrated for zero and span, in hardware

or in software. The AI shall incorporate common mode noise rejection of 50 dB from 0 to 100 Hz for differential inputs, and normal mode noise rejection of 20 dB at 60 Hz from a source impedance of 10,000 ohms. Input ranges shall be within the range of 0-to-5 VDC, 0-to-10 VDC or 4-20 mA where applicable.

2.17.1.7.2 The Analog Output (AO) function shall accept digital data, perform D-to-A conversion, and output a signal within the range of 0-to-5 VDC, 0-to-10 VDC and 4-20 mA where applicable. D-to-A conversion shall have a minimum resolution of 8 bits plus sign. Analog outputs shall be individually calibrated for zero and span. Short circuit protection on voltage outputs and open circuit protection on current outputs shall be provided. An individual gradual switch for manual override of each analog output and means of physically securing access to these switches shall be provided. Each AO shall have a three-position switch for selection of the DDC control signal, no control, or a locally generated control signal for connection to the controlled device. Feedback shall be provided to the system as to the status of the output (manual control or automatic). Switches for pneumatic control outputs shall provide a connection for an externally generated pneumatic signal. All switches shall be either of a key operated design with the same keying system used for other outputs or otherwise suitably protected from unauthorized access.

2.17.1.7.3 The Digital Input (DI) function shall accept on-off, open-close, or other change of state (two state data) indications. Isolation and protection against an applied steady-state voltage up to 180 Vac peak shall be provided.

2.17.1.7.4 The Digital Output (DO) function shall provide contact closures for momentary and maintained operation of output devices. Closures shall have a minimum duration of 0.1 second. DO relays shall have an initial breakdown voltage between contacts and coil of at least 500 V peak. Electromagnetic interference suppression shall be furnished on all output lines to limit transients to nondamaging levels. Protection against an applied steady-state voltage up to 180 Vac peak shall be provided. Minimum contact rating shall be 1 ampere at 24 Vac. Key locked HOA switches shall be provided for manual override of each digital output. Feedback shall be provided to the system as to the status of the output (manual control or automatic). All switches shall be common keyed.

2.17.1.7.5 The pulse accumulator function shall have the same characteristics as the DI. In addition, a buffer shall be provided to totalize pulses and allow for interrogation by the DDC panel. The pulse accumulator shall accept rates up to 20 pulses per second. The totalized value shall be reset to zero upon operator's command.

2.17.1.7.6 Signal conditioning for sensors shall be provided as specified.

2.17.2 Variable Air Volume (VAV) Terminal Unit Controls: The VAV terminal units shall be as specified in SECTION 15880, AIR DISTRIBUTION EQUIPMENT. Terminal unit controls shall consist of individual box controllers which shall be fully interfaced to the control system through dedicated DDC panels. VAV terminal box controllers shall be interfaced to the system through the DDC panel that controls the AHU serving that box.

2.17.2.1 Box Control Device: Controls for pressure independent boxes shall consist of a velocity-sensing device in the primary air entering the box, a room temperature sensing element, a damper actuator, and an adjustable micro-

processor-based VAV box controller. Each controller shall operate a damper for cooling and a duct coil for heating. Actuator shall open or close the device to which it is applied within 6 minutes. Terminal unit controls shall meet the requirements of UL 916 and 47 CFR 15.

2.17.3 Portable Workstation/Tester: An IBM compatible personal computer (notebook) shall be provided for use with DDC panels. Portable workstation/tester is not required when Johnson Controls Metasys equipment is furnished and installed.

2.17.3.1 Computer Capabilities: The workstation/tester shall be provided with communications interfaces to each DDC panel and shall:

2.17.3.1.1 Allow for entry of database information, including parameters and constraints from the keyboard.

2.17.3.1.2 Display any digital, analog, and pulse accumulator input.

2.17.3.1.3 Control any digital and analog output.

2.17.3.1.4 Provide operator interface in alphanumeric and decimal.

2.17.3.1.5 Disable/enable any DDC panel.

2.17.3.2 Computer Features: The workstation/tester shall include the following features as a minimum:

2.17.3.2.1 Microsoft Windows 2000 software.

2.17.3.2.2 Pentium III or IV microprocessor running at 500MHz.

2.17.3.2.3 14.0 inch XGA TFT display.

2.17.3.2.4 64MB 100 MHz SDRAM.

2.17.3.2.5 5GB hard drive.

2.17.3.2.6 1.44MB, 3.5 inch diskette drive.

2.17.3.2.7 32x max variable CD-ROM drive.

2.17.3.2.8 8MB graphics card.

2.17.3.2.9 56K capable data/fax modem.

2.17.3.2.10 Sound card.

2.17.3.2.11 Network interface card.

2.17.3.2.12 On-board mouse.

2.17.3.3 Communications: A port and proper cabling shall be provided to allow for communications between the portable workstation/tester and the DDC panel.

2.17.4 Communication Equipment: The DDC panel shall be equipped with LAN card and hardware to allow for communication over Data Transmission Media (DTM) using the communication network.

2.18 DIRECT DIGITAL CONTROL PANEL SOFTWARE: Each DDC panel, shall contain an operating system that controls and schedules that DDC panel's activities in real time. The DDC panel shall maintain a point database in its RAM that includes all parameters, constraints, and the latest value or status of all points connected to that DDC panel. The operating system shall include a real time clock function that maintains the seconds, minutes, hours, date and month, including day of the week. The operating system shall allow local loading of software and data files from the portable tester and from an operator interface panel. Graphic Programming Language (GPL) shall be utilized for programming. In the event there is program loss in the field DDC, the program will be downloaded automatically from the PC workstation archive computer in Building 364.

2.18.1 Command Priorities: A scheme of priority levels shall be provided to prevent interaction of a command of low priority with a command of higher priority. The system shall require the latest highest priority command addressed to a single point to be stored for a period of time longer than the longest time constraint in the on and off states, ensuring that the correct command will be issued when the time constraint is no longer in effect or report the rejected command. Override command entered by the operator shall have higher priority than those emanating from application programs.

2.18.2 DDC Panel Startup: The DDC panel shall have startup software that causes automatic commencement of operation without human intervention, including startup of all connected I/O functions. A DDC panel restart program based on detection of power failure at the DDC panel shall be included in the DDC panel software. Upon restoration of power to the DDC panel, the program shall restart all equipment and restore all loads to the state at time of power failure, or to the state as commanded by time programs or other overriding programs. The restart program shall include start time delays between successive commands to prevent demand surges or overload trips. The startup software shall initiate operation of self-test diagnostic routines. Upon failure of the DDC panel and if the database and application software are no longer resident, or if the clock cannot be read, the DDC panel shall not restart and systems shall remain in the failure mode until the necessary repairs are made. If the database and application programs are resident, the DDC panel shall resume operation after an adjustable time delay of from 0 to 600 seconds. The startup sequence for each DDC panel shall include a unique time delay setting when system operation is initiated.

2.18.3 DDC Panel Operating Mode: Each DDC panel shall control and monitor all functions independent of communication with any other source. The software shall perform DDC panel functions and DDC panel resident application programs using data obtained from I/O functions and based upon the DDC panel real time clock function. The DDC panel software shall execute commands after performing constraint checks in the DDC panel.

2.18.4 DDC Panel Failure Mode: Upon failure for any reason, the system shall perform an orderly shutdown and force all DDC panel outputs to a predetermined state, consistent with the failure modes defined in the I/O summary tables and the associated controlled devices.

2.18.5 DDC Panel Functions: Software necessary to accomplish the following functions, as appropriate, fully implemented and operational, within the DDC panel shall be provided:

2.18.5.1 Scanning of inputs.

2.18.5.2 Control of outputs.

2.18.5.3 Store alarms for reporting when requested.

2.18.5.4 Maintain real time.

2.18.5.5 Execute DDC panel resident application programs.

2.18.5.6 Averaging or filtering of each analog input.

2.18.5.7 Constraint checks, prior to command issuance.

2.18.5.8 DDC panel diagnostics.

2.18.5.9 DDC panel portable tester operation.

2.18.6 Analog Monitoring: The DDC panel shall measure analog values and shall be capable of transmitting analog values for display. An analog change in value is defined as a change exceeding a preset differential value as specified. Displays and reports shall express analog values in proper engineering units with polarity sign. The system shall accommodate up to 255 different sets of engineering unit conversions. Each engineering unit conversion shall include range, span, and conversion equation.

2.18.7 Logic (Virtual) Points: Logic (virtual) points shall be software points entered in the point database which are not directly associated with a physical I/O function. This value shall be created by calculating it from any combination of digital and analog points, or other data. Logic points shall be analog or digital points having all the properties of real points, including alarms, without the associated hardware. Logic points shall be defined or calculated and entered into the database by the Contractor as required. The calculated analog point shall have point identification in the same format as any other analog point. The calculated point shall be used in any program where the real value is not obtainable directly. Calculated point values shall be current for use by the system within 30 seconds of the time any input value changes and shall include:

2.18.7.1 Control loop setpoints.

2.18.7.2 Control loop gain constants.

2.18.7.3 Control loop integral constants.

2.18.7.4 Summer/winter operation.

2.18.7.5 Real time.

2.18.7.6 Scheduled on/off times.

2.18.7.7 Equipment run-time targets.

2.18.7.8 Calculated point values.

2.18.8 I/O Point Definition: Each I/O point shall be defined in a database in the DDC panel. The definition shall include all physical parameters and constraints associated with each point.

2.18.9 Parameter Definition: Each I/O point shall be defined and entered into the database by the Contractor, including as applicable:

2.18.9.1 Name.

2.18.9.2 Device or sensor type (i.e., sensor, control, motors).

2.18.9.3 Point identifications number.

2.18.9.4 Area.

2.18.9.5 Sensor range.

2.18.9.6 Controller range.

2.18.9.7 Sensor span.

2.18.9.8 Controller span.

2.18.9.9 Engineering units conversion (scale factor).

2.18.9.10 High and low reasonableness value (analog).

2.18.9.11 High and low alarm limit (analog).

2.18.9.12 High and low alarm limit differential (return to normal).

2.18.9.13 Analog change differential (for reporting).

2.18.9.14 High accumulator limit (pulse).

2.18.9.15 Status description (digital inputs).

2.18.10 Alarm Processing: Each DDC panel shall have alarm processing software for digital, analog, and pulse accumulator alarms for all input and virtual points connected to that DDC panel.

2.18.10.1 Digital Alarms Definition: Digital alarms are those abnormal conditions indicated by digital inputs as specified in the I/O Summary Tables and elsewhere.

2.18.10.2 Analog Alarms Definition: Analog alarms are those conditions higher or lower than a defined value, as measured by an analog input as specified in the I/O Summary Tables and elsewhere. Analog readings shall be compared to predefined high and low limits, and alarmed each time a value enters or returns from a limit condition. Unique high and low limits shall be assigned to each analog point in the system. Analog alarm limits shall be stored in the DDC panel database. Each analog alarm limit shall have an associated unique limit differential specifying the amount by which a variable must return to the proper operating range before being declared as a return-to-normal state. Limits and differentials shall be entered on line by the

operator in limits or the measured variable, without interruption or loss of monitoring of the point concerned.

2.18.10.3 Pulse Accumulator Alarms Definition: Pulse accumulator alarms are those conditions calculated from totalized values of accumulator inputs or pulse accumulator inputs rates that are outside defined limits as specified in the I/O Summary Tables and elsewhere. Pulse accumulator totalized values shall be compared to predefined limits and alarmed each time a value enters a limit condition. Unique limits shall be assigned to each pulse accumulator point in the system. Limits shall be stored in the DDC panel database.

2.18.10.4 Equipment Constraints Definitions: Each control point in the database shall have DDC panel resident constraints defined and entered by the Contractor, including as applicable:

2.18.10.4.1 Minimum off time.

2.18.10.4.2 Minimum on time.

2.18.10.4.3 High limit (value in engineering units). d. Low limit (value in engineering units).

2.18.10.5 Constraint Checks: Control devices connected to the system shall have the DDC panel memory resident constraints checked before each command is issued to ensure that no equipment damage will result from improper operation. Each command shall be executed by the DDC panel only after all constraint checks have been passed. Each command point shall have unique constraints assigned. High and low "reasonableness" values or one differential "rate-of-change" value shall be assigned to each analog input. Values outside the reasonableness limits shall be rejected and an alarm generated. Status changes and analog point values shall be reported upon request, such as for reports, and application programs. Each individual point shall be capable of being selectively disabled by the operator. Disabling a point shall prohibit monitoring and automatic control of that point.

2.18.11 DDC Panel Diagnostics: Each DDC panel shall have self-test diagnostic routines implemented in firmware. The tests shall include routines that exercise memory. Diagnostic software shall be provided for use in the portable tester. The software shall display messages in plain language to inform the tester's operator of diagnosed problems.

2.18.12 Summer/Winter Operation Monitoring: The system shall provide software to change the operating parameters, monitoring of alarm limits, and start-stop schedules for each mechanical system where such a change from summer to winter and vice versa is meaningful. The software shall provide commands to application programs to coordinate summer or winter operation.

2.18.13 Control Sequences and Control Loops: Operator commands shall be used to create and execute control sequences and control loops for automated control of equipment based on operational parameters including times and events, defined in the database. Through the command entry device, the system shall prompt the operator for information necessary to create, modify, list, and delete control sequences and Proportional-Integral (PI) control loops. The system shall prompt the operator for confirmation that the control sequence and control loop addition/modification/deletion is correct, prior to placing it in operation. Mathematic functions required shall be available for use in creating the control sequences and control loops. Suf-

ficient spare memory shall be provided to allow four control sequences and four control loops in addition to those necessary to implement the requirements specified for each DDC panel. Each control sequence shall accommodate up to eight terms or devices.

2.18.13.1 Control Functions: The DDC panel shall provide the following control functions:

2.18.13.1.1 Two Position Control: This function shall provide control for two state device control by comparing a setpoint against a process variable and an established deadband.

2.18.13.1.2 Floating Point Control: This function shall exercise control when an error signal exceeds a selected deadband, and shall maintain control until the error is within the deadband limits.

2.18.13.1.3 Signal Selection: This function shall allow the selection of the highest or lowest analog value from a group of analog values as the basis of control. The function shall include the ability to cascade analog values so that large numbers of inputs, up to a maximum of 20, can be reduced to one or two outputs.

2.18.13.1.4 Reset Function: This function shall develop an analog output based on up to two analog inputs and one operator specified reset schedule.

2.18.13.1.5 Self Tuning: The controller shall provide self tuning operation to proportional, integral and derivative modes of control and shall modify the mode constants as required.

2.18.13.2 DDC Panel Resident Applications Software: Application software required to achieve the sequences of operation, parameters, constraints, and interlocks necessary to provide control of the systems connected to the DDC system shall be provided. Application software shall be resident and executing in the DDC panel, and shall be coordinated to ensure that no conflicts or contentions remain unresolved.

2.18.14 Communication Programs: The DDC panels shall be equipped with software drivers and handlers which allow for full communication and interface of all points with all the existing EMCS workstations (including all M5 workstations), EMCS laptop workstations (utilized in the field)and the EMCS engineering workstation located in the Administration Building No. 364. The software drivers shall allow for communications via modems, line drivers, transmitters/receivers over LAN, wirelines, fiber optic or coaxial cables. The software shall be structured to support communication over a network with star, ring, radial, or a combination of topologies. Each communication program module shall be functionally independent of other Contractor-furnished software, to allow for future upgrade or replacement of communication modules without affecting other application programs and other software modules. Communication protocol for communication shall conform to a standard communication protocol.

2.19 EXISTING ENERGY MANAGEMENT SYSTEM INTERFACE: The network control unit shall be interfaced to the existing UMCS by physical connection to the basewide LAN. The existing UMCS shall provide global capabilities for the monitoring and control of the network controller.

2.19.1 Existing EMS Software Interface:

2.19.1.1 All points in the network controller panel shall be able to be used in all of the UMCS software application features. This integration shall be done on-line through the UMCS's system programming.

2.19.1.2 The network controller programming language shall be designed for HVAC and energy management applications. All digital system controller programming, editing, and data base generation, as well as definition of the monitor, control, and reporting functions shall be performed on-line at the UMCS operator station.

2.19.1.3 The network controller programs shall be stored both in the individual panel and in the mass storage device at the existing UMCS front end. The network controller shall accept downloading of the software program from the UMCS.

2.19.2 New Point Definition: The control contractor shall provide technical service to define the new network controller monitoring and control points at the existing UMCS workstation. In addition, the control contractor shall implement those points into any UMCS software programs at the Contracting Officer's discretion.

2.20 OPERATOR INTERFACE:

2.20.1 Command Entry/ Selection Process: Operator interface software shall minimize operator training through the use of English language prompting and English language point identification.

2.20.2 Text-Based Display: The Operator interface shall provide consistent text-based displays of all system point and application data described in this specification. Point identification, engineering units, status indication, and application naming conventions shall be the same at all operator devices.

2.20.3 Password Protection: Multiple-level password access protection shall be provided to allow the user/manager to limit control, display, and data base manipulation capabilities as he deems appropriate for each user, based upon an assigned password.

2.20.3.1 Passwords shall be exactly the same for all operator devices.

2.20.3.2 A minimum of three levels of access shall be supported.

2.20.3.3 A minimum of 4 passwords shall be supported at each Digital Panel.

2.20.3.4 Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed at any operator device shall be limited to only those items defined for the access level of the password used to log-on.

2.20.3.5 User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving devices on-line.

2.20.4 Operator Commands: The operator interface shall allow the operator to perform commands including, but not limited to, the following:

2.20.4.1 Start-up or shutdown selected equipment.

2.20.4.2 Adjust setpoints.

2.20.4.3 Add/Modify/Delete time programming.

2.20.4.4 Enable/Disable process execution.

2.20.4.5 Lock/Unlock alarm reporting for each point.

2.20.4.6 Enable/Disable Totalization for each point.

2.20.4.7 Enable/Disable Trending.

2.20.4.8 Enter temporary override schedules.

2.20.4.9 Define Holiday Schedules.

2.20.4.10 Change time/date.

2.20.4.11 Enter/Modify analog alarm limits.

2.20.4.12 Enable/Disable demand limiting.

2.20.4.13 Enable/Disable duty cycle.

2.20.5 Logs and Summaries: Reports shall be generated manually, and directed to the displays. As a minimum, the system shall allow the user to easily obtain the following types of reports:

2.20.5.1 A general listing of all points in the system shall include, but not be limited to, the following:

2.20.5.1.1 Points currently in alarm.

2.20.5.1.2 Off-line points.

2.20.5.1.3 Points currently in override status.

2.20.5.1.4 Points in Weekly Schedules.

2.20.5.1.5 Holiday Programming.

2.20.5.2 Summaries shall be provided for specific points, for a logical point group, for a user-selected group of groups, or for the entire facility without restriction due to the hardware configuration of the facility management system.

2.20.5.3 Under no conditions shall the operator need to specify the address of hardware controller to obtain system information.

2.20.6 Energy Saving Reports: Software shall be capable of generating monthly energy savings reports. These reports shall include each HVAC system with the associated savings printed out in actual dollars and cents saved. The savings would be generated by utilizing energy saving routines included in software. The contractor shall generate the above energy saving reports as part of this project.

2.20.7 System Configuration and Definition: All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.

2.20.7.1 Functions: The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform the following functions:

2.20.7.1.1 Add/Delete/Modify Application Specific Controllers.

2.20.7.1.2 Add/Delete/Modify points of any type, and all associated point parameters, and tuning constants.

2.20.7.1.3 Add/Delete/Modify alarm reporting definition for each point.

2.20.7.1.4 Add/Delete/Modify energy management applications.

2.20.7.1.5 Add/Delete/Modify time and calendar-based programming.

2.20.7.1.6 Add/Delete/Modify Totalization for every point.

2.20.7.1.7 Add/Delete/Modify Historical Data Trending for every point.

2.20.7.1.8 Add/Delete/Modify configured control processes.

2.20.7.1.9 Add/Delete/Modify dial-up telecommunication definition.

2.20.7.1.10 Add/Delete/Modify all operator passwords.

2.20.7.1.11 Add/Delete/Modify Alarm Messages.

2.20.7.2 Programming Description: Definition of operator device characteristics, DDC Panels, individual points, applications and control sequences shall be performed through fill-in-the-blank templates.

2.20.7.2.1 Network-Wide Strategy Development: Inputs and outputs for any process shall not be restricted to a single DDC Panel but shall be able to include data from any and all other DDC panels to allow the development of network-wide control strategies.

2.20.7.3 System Definition/Control Sequence Documentation: All portions of system definition shall be self-documenting to provide hard copy printouts of all configuration and application data.

2.20.7.4 Data Base Save/Restore/Back-up: Back-up copies of all digital panel data bases shall be stored in at least one personal computer. Users shall also have the ability to manually execute downloads of digital panel data base. The Network/Data base shall also be stored on a rewritable CD ROM or magnetic tape.

2.20.8 Dynamic Color Graphic Displays: Color graphic floor plan displays, and system schematics for each piece of mechanical equipment, including air handling units, chilled water systems, heating/ventilation systems, boiler systems (steam and hot water), pumping systems, exhaust fan systems and at a minimum one typical graphic for each different type of Variable Air volume

(VAV) box and hot water boiler systems, shall be generated to optimize system performance analysis and speed alarm recognition. The existing operator interface workstation located in Building 364 is available for operator interface provided the existing Johnson Metasys System is utilized. If another vendor is proposed, a new graphics package and operator workstation shall be provided with the proposed system, in addition to interfacing with the existing Metasys system.

2.20.8.1 System Selection/Penetration: The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, or text-based commands.

2.20.8.2 Dynamic Data Displays: Dynamic temperature valves and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention.

2.20.8.3 Graphics Definition Package: Graphic generation software shall be provided to allow the user to add, modify, or delete system graphic displays.

2.20.8.3.1 The contractor shall provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g., fans, cooling coils, filters, dampers, etc.); complete mechanical systems (e.g., constant volume-terminal reheat, VAV, etc.) and electrical symbols.

2.20.8.3.2 The graphic development package shall use a mouse or similar pointing device in conjunction with a drawing program to allow the user to perform the following:

2.20.8.3.2.1 Define symbols.

2.20.8.3.2.2 Position and size symbols.

2.20.8.3.2.3 Define background screens.

2.20.8.3.2.4 Define connecting lines and curves.

2.20.8.3.2.5 Locate, orient and size descriptive text.

2.20.8.3.2.6 Define and display colors for all elements.

2.20.8.3.2.7 Establish correlation between symbols or text and associated system points or other displays.

2.20.8.3.3 Graphical displays can be created to represent any logical grouping of system points or calculated data based upon building function, mechanical system, building layout, or any other logical grouping of points which aids the operator in the analysis of the facility. To accomplish this, the user shall be able to build graphic displays that include point data from multiple application specific controllers.

2.20.9 Personal Computer Operator Interface: The personal computer shall remotely connect to the network of digital panels. Operator workstation shall be located in the EMCS Shop, building 364. At Contractor’s option, the existing operator work station in building 364 may be utilized for the building DDC system operator interface provided a Johnson Metasys system is furnished for the buildings in this contract. The existing software shall be

modified and/or expanded to include all the graphic displays and monitoring systems for the buildings in this contract. Note: An existing Johnson Controls Metasys DDC System is currently utilized for base EMCS functions. Any system proposed other than Metasys shall be required to fully interface with and integrate with the Metasys system via a "gateway" or other protocol-conversion device. By performing an integration of the two systems, it is mandatory that all functionality remain intact so that the systems can coexist on the same network. The Contractor shall demonstrate the proposed system's compatibility with the existing UMCS system within 45 days of the receipt of the notice-to-proceed and/or prior to submissions.

2.20.9.1 General Description: The personal computer (desktop) shall be general purpose and commercially available, with sufficient memory and processor capacity to perform all functions described in this specification.

2.20.9.2 Capabilities: Personnel computer workstations shall be provided for command entry, information management, network alarm management, and data base management functions.

2.20.9.3 Data Base Save/Restore/Back-Up: Back-up copies of all digital panel data shall be stored in the personal computer. The network/data base shall also be stored on a rewritable CD-ROM.

2.20.9.4 Features: Central workstation shall include the following features as a minimum:

2.20.9.4.1 Microsoft Windows NT (latest version) software.

2.20.9.4.2 Pentium III or IV microprocessor running at 1.0GHz.

2.20.9.4.3 128MB 133MHz SDRAM.

2.20.9.4.4 20GB hard drive.

2.20.9.4.5 17 inch, 1024 by 768 Resolution (.26 Dot Pitch), SVGA color monitor.

2.20.9.4.6 16MB graphics card.

2.20.9.4.7 1.44MB, 3.5 inch diskette drive.

2.20.9.4.8 8x/4x/32x CD-RW drive.

2.20.9.4.9 64V PCI sound card and speakers.

2.20.9.4.10 V.90/56K PCI data/fax modem.

2.20.9.4.11 Network interface card.

2.20.9.4.12 101 key standard keyboard.

2.20.9.4.13 3-button wheel mouse.

2.20.9.4.14 Laser jet printer, 600 by 600 dpi, 8 ppm.

2.21 PNEUMATIC POWER SUPPLY AND PIPING:

2.21.1 Air Compressor: Provide tank-mounted, electric motor-driven, air-cooled, oil-less, reciprocating type air compressor including motor, controller, pressure switch, belt guard, pressure reducing valve, pressure relief valve, automatic moisture drain valve, air intake filter, and silencer. Piston speed shall not exceed 40 fpm. Set relief valve for 10 psig above the control switch cut-off pressure. Pressure switches shall start compressor at 70 psig and stop compressor at 90 psig. Size each compressor to run not more than 33 percent of the time with full system control load. Provide duplex air compressors with electric alternator switch and electrical duplex controller for systems having more than 50 control devices.

2.21.2 Compressed Air Tank: Provide zinc-coated steel tank constructed in accordance with the ASME BPVC, Sec VIII, Div 1, for not less than 125 psig working pressure with 20 gallons minimum capacity; size tank such that idle time between compressor running periods shall be not less than 6 minutes with full system control load.

2.21.3 Intake Air Filter and Silencer: Provide dry-type combination intake air filter and silencer with baked enamel steel housing. Filter shall be 99 percent efficient at 10 micron rating and provide residential class intake air silencer.

2.21.4 Refrigerated Air Dryer: Size dryer to reduce the compressed air dew-point temperature to 0 degrees F. Provide devices for automatic draining of condensed water and oil.

2.21.5 Compressed Air Filter: Provide dry type filter, 99 percent efficient in removing oil and solid particles at 0.03 micron rating, with baked enamel steel housing and manual drain valve.

2.21.6 Pressure Reducing Station: Providing pressure reducing valve (PRV) with field adjustable range of zero to 50 psig discharge pressure, with inlet pressure of 70 to 90 psig. Provide factory set pressure relief valve to relive overpressure downstream of PRV exceeding 25 psig. Provide inlet pressure gage with range of zero to 100 psig, and outlet pressure gage with range of zero to 30 psig.

2.21.7 Pneumatic Piping: Run concealed where possible in finished areas, and run exposed in unfinished areas such as mechanical equipment rooms and shop areas. Run piping to be enclosed in concrete, in rigid metal or intermediate metal conduit. Provide piping in a neat and workmanlike manner throughout and free of leaks. Maximum spacing between piping supports shall be 5 feet. Test each piping system pneumatically at 1.5 times the working pressure for 24 hours, with a maximum pressure drop of 1 psig. Correct joint leaks by remaking of the joint; calking of joints will not be permitted. Piping shall be copper, polybutylene, or polyethylene tubing as specified herein. Piping and two insulated copper phone wires for installation checkout may be run in the same conduit; piping and electrical power conductors shall not be run in the same conduit; however, control circuit conductors may be run in the same conduit as polybutylene or polyethylene tubing. Exposed piping shall be copper tubing.

2.21.7.1 Copper Tubing: Copper tubing shall conform to ASTM B75 or ASTM B88. Tubing 0.375 inch outside diameter and larger shall have minimum wall thickness equal to ASTM B88, Type M. Tubing less than 0.375 inch outside diameter shall have minimum wall thickness of 0.025 inch. Concealed piping shall be hard or soft copper tubing; multiple piping shall be racked or bun-

dled. Exposed piping shall be hard copper tubing; rack multiple piping. Fittings shall be solder type and conform to ANSI B16.18 or ANSI B.16.22, when using ASTM B32, or compression type conforming to ANSI B16.26.

2.21.7.2 Polybutylene and Polyethylene Tubing: Piping shall be multiple polybutylene or polyethylene tubing in extruded polyvinyl chloride (PVC) protective sheath, or unsheathed polybutylene or polyethylene tubing in rigid metal, intermediate metal or electrical metallic tubing conduit. Single unsheathed polybutylene or polyethylene tubing may be used within control panels only. Number each tube. Fittings shall be compression or barbed push-on type. Polybutylene plastic tubing shall conform to ASTM D2666. Polyethylene plastic tubing shall conform to ASTM D2737. Plastic tubing shall have the burning characteristics of linear low-density polyethylene tubing, shall be self-extinguishing when tested in accordance with ASTM D635, shall have UL 94 V-2 flammability classification, and shall withstand stress cracking when tested in accordance with ASTM D1693. Plastic-tubing bundles shall be provided with Mylar barrier and flame-retardant polyethylene jacket.

2.21.7.3 Stainless Steel: Stainless steel tubing shall conform to ASTM A269 and shall have stainless steel compression fittings.

PART 3 EXECUTION

3.1 GENERAL: Install direct digital HVAC control systems as indicated on the plans and specified herein.

3.2 INSTALLATION:

3.2.1 HVAC Control System: The HVAC control system shall be completely installed and ready for operation. 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.

3.2.2 Software Installation: Software shall be loaded for an operational system, including databases for all points, operational parameters, and system, command, and application software. The Contractor shall provide original and backup copies of source, excluding the general purpose operating systems and utility programs furnished by computer manufacturers and the non-job-specific proprietary code furnished by the system manufacturer, and object modules for all software on each type of media utilized, within 30 days of formal Government acceptance. In addition, a copy of individual floppy disks of all software for each DDC panel shall be provided.

3.2.3 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.

3.2.4 Wiring Criteria: Wiring external to control panels, including low-voltage wiring, shall be installed in metallic or PVC raceways (NO EXCEPTIONS). Wiring shall be installed without splices between control devices and DDC panels. Instrumentation grounding shall be installed as necessary to prevent ground loops, noise, and surges from adversely affecting operation of the system. Cables and conductor wires shall be tagged at both ends, with the identifier shown on the shop drawings, in accordance with the requirements of SECTION 16050, ELECTRICAL.

3.3 CONTROL-SYSTEM INSTALLATION:

3.3.1 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.

3.3.2 Room-Instrument Mounting: Room instruments shall be mounted so that their sensing elements are 5 feet above the finished floor unless otherwise shown. Temperature setpoint device shall be recess mounted.

3.3.3 Freezestats: For each 20 square feet of coil-face area, or fraction thereof, a freezestat shall be provided to sense the temperature at the location shown. Manual reset freezestats shall be installed in approved, accessible locations where they can be reset easily. The freezestat sensing element shall be installed in a serpentine pattern.

3.3.4 Averaging-Temperature Sensing Elements: Sensing elements shall have a total element minimum length equal to 1 linear foot per square foot of duct cross-sectional area.

3.3.5 Duct Static-Pressure Sensing Elements and Transmitters: The duct static-pressure sensing element and transmitter sensing point shall be located approximately two-thirds of the distance from the supply fan to the end of the duct with the greatest pressure drop.

3.4 CONTROL SEQUENCES OF OPERATION:

3.4.1 General Requirements - HVAC System: 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 or pressure. The reverse sequence shall occur when the direction of change is reversed.

3.4.1.1 Supply Fan Operating: HVAC system outside air and return air dampers shall function as described for specific modes of operation. Cooling-coil control valves and cooling-coil circulating pumps shall function as described for the specific modes of operation unless their control is assumed by the freeze-protection system. Heating coil valves shall be under control.

3.4.1.2 Supply Fan Not Operating: When an HVAC system is stopped, the outside air dampers shall close, the return air damper shall open, and all cooling-coil valves for coils located indoors shall close to the coil. Heating-coil valves shall remain under control.

3.4.2 Unit Heater and Cabinet Unit Heater: All Modes - A wall-mounted thermostat with an "AUTO-OFF" switch located as shown, shall cycle the fan to maintain its setpoint (68 degree F. adjustable) when the switch is in the "AUTO" position. When the switch is in the "OFF" position, the fan shall be stopped.

3.4.3 Single Building Hydronic Heating with Hot Water Boiler:

3.4.3.1 All Modes: The DDC system shall accept a signal from a sunshielded outside air temperature sensing element and transmitter. The DDC system shall start distribution pump, boiler pump , and boiler as the outside air temperature drops to 65 degrees F. Additional boiler pump and boiler will be started as heating load increases. The DDC system shall accept a signal from a temperature sensing element and transmitter located in the hydronic-heating supply line and the DDC system output shall enable boilers to maintain the reset schedule setpoint in the hydronic-heating supply line as follows:

Outside Air Temperature	Hot Water Supply Temperature
0 degrees F.	180 degrees F. (adjustable)
60 degrees F.	140 degrees F. (adjustable)

3.4.4 Single Building Hydronic Cooling with Water Chiller:

3.4.4.1 Chilled water pump start/stop and chiller enable/disable is issued by the DDC system based on scheduled occupancy. The chilled water system may also be optimally started based on outside air temperature and space temperature.

3.4.4.2 Existing chiller internal control will be by chiller manufacturer. DDC shall enable/disable chiller by interrupting flow switch circuit. Maintain chilled water pump operation for 5 minutes (adj.) upon chiller disable.

3.4.4.3 Chilled water temperature reset shall be provided by make and break of internal chiller call for cooling control circuit.

Outside Air Temperature	Chilled Water Supply Temperature
75 degrees F.	45 degrees F.
65 degrees F.	55 degrees F.

3.4.5 Variable Air Volume Control Sequence without Return Fan:

3.4.5.1 Occupied, Unoccupied, and Ventilation-Delay Modes of Operation: Ventilation-delay mode timing shall start prior to the occupied-mode timing. The DDC system shall prevent the outside air damper from opening. The DDC system shall place the system in the occupied mode in accordance with the building operating schedule. At the expiration of the ventilation-delay mode timing period, the DDC system shall allow the outside air damper to open. The DDC system shall place the control system in the unoccupied mode of operation in accordance with the building operating schedule.

3.4.5.2 Outside Air and Return Air Dampers:

Occupied Mode - The outside air and return air dampers shall be under mixed-air temperature and economizer control.

Unoccupied Mode - The dampers shall return to their normal positions as shown, (outside air NC, return air NO) except when under economizer control.

Ventilation-Delay Mode - The dampers shall return to their normal positions as shown, except when under economizer control.

3.4.5.3 Supply-Fan Control:

Occupied and Ventilation-Delay Modes - Supply fan shall start, and operate continuously.

Unoccupied Mode - The supply fan shall cycle to maintain zone unoccupied set-back schedule. The fan shall start and stop at the setpoints as shown.

Unoccupied Setback Schedule

Winter Heating	65 degrees F
Summer Cooling	85 degrees F

3.4.5.4 Supply-Duct Pressurization Control: When the supply fan starts, the DDC system shall modulate the fan speed from the signal of a static pressure-sensing element and transmitter to maintain the setpoint (1 inch WC, adj.).

3.4.5.5 Filter: A differential pressure switch across the filter shall initiate a filter alarm when the pressure drop across the filter reaches the setpoint as shown (0.5 inch WC, adj.).

3.4.5.6 Freeze Protection: All Modes - A freezestat, located as shown, shall stop the supply fan, cause the outside air and return air dampers to return to their normal position, and shall initiate a low temperature alarm if the temperature drops below the freezestat's setpoint (37 degree F. adjustable). Return to the normal mode of operation shall require manual reset at the freezestat. The DDC panel shall monitor the freezestat through auxiliary contacts and shall indicate an alarm condition when the freezestat trips.

3.4.5.7 Cooling Coil: Occupied and Ventilation-Delay Modes - The control valve shall be modulated by the DDC system from the signal of a temperature sensing element and transmitter located in the coil discharge air to maintain the setpoint (55 degrees F). The normal discharge temperature setpoint shall be allowed to rise (setpoint reset) as the volume of air handled by the supply fan decreases. The rise in temperature will be 1 degree for each 10% reduction in total higher air volume, or a ratio specified by the user.

Unoccupied Mode - When the supply fan is off, the DDC system shall close the cooling-coil control valve.

3.4.5.8 Economizer Control: The DDC system shall accept the signal of an outside air temperature sensing element and transmitter and the signal of a return air temperature sensing element and transmitter. The DDC system shall perform switchover between outside air economizer control mode and minimum outside air mode. Until the return air temperature rises above the setpoint (75 degree F. adjustable), the DDC system shall hold the system in the minimum outside air mode. When the return air temperature rises above the setpoint, the DDC system shall place the AHU 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. When the outside air temperature is low with respect to the return air temperature, the AHU shall be in the economizer mode. When the DDC system places the control system in the minimum outside air mode, the outside air damper shall be open to the minimum outdoor air setting.

3.4.5.9 Mixed Air Temperature Control: When the DDC system places the system in the economizer mode, it shall modulate the dampers from the signal of a temperature-sensing element and transmitter in the mixed-air stream to maintain the setpoint (55 degrees F.). The normal discharge temperature setpoint shall be allowed to rise (setpoint reset) as the volume of air handled by the supply fan decreases. The rise in temperature will be 1 degree for each 10% reduction in total higher air volume, or a ratio specified by the user.

3.4.5.10 Pressure-Independent Terminal VAV Box with Velocity Controller: All Modes - The control damper of the VAV box shall modulate in response to the signal from a flow sensing element at the discharge or inlet of the VAV box to a microprocessor-based VAV-box velocity controller. The velocity controller shall control the box damper from the minimum-flow position to the full-flow position from the signal of a space temperature sensing element located as shown. When the space temperature decreases, the damper shall gradually close to the minimum flow position to maintain the cooling setpoint. When the space temperature calls for heating after the minimum flow position is reached, control shall then pass through a temperature dead band. When the space temperature has dropped through the dead band, the duct heater coil shall be gradually controlled and the damper shall gradually open to maintain the heating setpoint.

3.5 COMMISSIONING PROCEDURES:

3.5.1 Evaluations: The Contractor shall make the observations, adjustments, calibrations, measurements, and tests of the control systems, set the time schedule, and make any necessary control-system corrections to ensure that the systems function as described in the sequence of operation.

3.5.1.1 Item Check: Signal levels shall be recorded for the extreme positions of each controlled device. 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 shut down; Step 4 shall be performed after the HVAC systems have been started. External input signals to the DDC panel (such as starter auxiliary contacts, and external systems) may be simulated in steps 1, 2, and 3. With each operational-mode signal change, DDC panel output relay contacts shall be observed to ensure that they function.

3.5.1.2 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 actual results shall be verified in the appropriate season.

3.5.1.3 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 DDC 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 ele-

ment-to-DDC panel readout accuracy. The calibration of the test instruments shall be traceable to National Institute Of Standards And Technology 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-DDC panel 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.

3.5.1.4 Insertion and Immersion Temperatures: Insertion temperature and immersion temperature sensing elements and transmitter-to-DDC panel readout calibration accuracy shall be checked at one physical location along the axis of the sensing element.

3.5.1.5 Averaging Temperature: Averaging-temperature sensing element and transmitter-to-DDC panel readout calibration accuracy shall be checked every 2 feet 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.

3.5.2 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 and turns on the unit heater fans. The unit heater fans shall not start. The "OFF/AUTO" switch shall be placed in the "AUTO" position. It shall be ensured that the unit-heater fans 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. The results of testing of one of each type of unit shall be logged.

3.5.3 Single Building Hydronic Heating with Hot Water Boiler: Steps for installation shall be as follows:

3.5.3.1 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 where required.

3.5.3.2 Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature-sensing element location. Each temperature shall be read at the DDC panel, and the thermometer and DDC panel readings logged. The calibration accuracy of the sensing element-to-DDC panel readout for outside air temperature and system supply temperature shall be checked.

3.5.3.3 Step 3 - Control-System Commissioning:

3.5.3.3.1 The two-point calibration sensing element-to-DDC panel readout accuracy check for the outside air temperature shall be performed. Any necessary software adjustments to setpoints or parameters shall be made to achieve the outside air temperature schedule.

3.5.3.3.2 The outside air temperature shall be simulated through an operator entered value to be above the setpoint. It shall be verified that pumps and boiler stop. A value shall be entered to simulate that the outside air temperature is below the setpoint as shown. It shall be verified that pumps start and boiler operates.

3.5.3.3.3 The two-point calibration accuracy check of the sensing element-to-DDC panel readout for the system-supply temperature shall be performed. The system-supply temperature setpoint shall be set for the temperature schedule as shown. Signals shall be sent to the DDC panel from the outside air temperature sensor, to verify that the system-supply temperature setpoint changes to the appropriate values.

3.5.4 Variable Air Volume Control System - Without Return Fan: Steps for installation shall be as follows:

3.5.4.1 Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. The system shall be checked to see that power is available where required, the outside air dampers are closed, the return air damper is open, and the cooling coil valve is closed.

3.5.4.2 Step 2 - Calibration Accuracy Check with HVAC System in Shutdown: Readings shall be taken with a digital thermometer at each temperature sensing element location. Each temperature shall be read at the DDC panel, and the thermometer and DDC panel display readings logged. The calibration accuracy of the sensing element-to-DDC panel readout for outside air, return air, mixed-air, and the cooling-coil discharge air temperatures shall be checked.

3.5.4.3 Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator through an operator entered value to the DDC panel. The proper operation of the actuators for all dampers and valves shall be visually verified. The signal shall be varied from live zero to full range, 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.

3.5.4.4 Step 4 - Control-System Commissioning:

3.5.4.4.1 With the fan ready to start, the system shall be placed in the ventilation-delay mode and in the occupied mode through operator entered values. It shall be verified that supply fan starts. It shall be verified that the outside air damper is closed, the return air damper is open, and the cooling coil valve is under control, by simulating a change in the fan discharge temperature. The system shall be placed out of the ventilation-delay mode, and it shall be verified that the outside air and return air dampers come under control, by simulating a change in the mixed air temperature.

3.5.4.4.2 The minimum outside air mode signal shall be applied, and it shall be verified that the outside air damper opens to its minimum position.

3.5.4.4.3 With supply fan running, a high static-pressure input signal shall be simulated at the device, by pressure input to the differential pressure switch sensing device. HVAC system shutdown shall be verified, it shall be verified that the high-static-pressure alarm is initiated. The differential pressure switch shall be set at the setpoint. The HVAC system shall be restarted by manual reset, and it shall be verified that the high static-pressure alarm returns to normal.

3.5.4.4.4 The two-point calibration accuracy check for sensing element-to-DDC panel readout for the static pressure in the supply duct shall be performed.

3.5.4.4.5 The two-point calibration accuracy check of the sensing element-to-DDC panel readout for outside air, return air, and mixed-air temperatures shall be performed.

3.5.4.4.6 The two-point calibration accuracy check of sensing element-to-DDC panel readout for the fan discharge temperature shall be performed. The set-point for the fan discharge temperature shall be set as shown. A change shall be simulated in the discharge air temperature through an operator entered value and it shall be verified that the control valve is modulated.

3.5.4.4.7 The system shall be placed in the unoccupied-mode and it shall be verified that the occupied-mode light turns off, the HVAC system shuts down, and the control system assumes the specified shutdown conditions. The space temperature shall be artificially changed to below the night setback temperature setpoint, and it shall be verified that the HVAC system starts; the space temperature shall be artificially changed to above the night setback setpoint, and it shall be verified that the HVAC system stops. The night setback temperature setpoint shall be set at the setpoint as shown.

3.5.4.4.8 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 alarm is initiated. The differential pressure switch shall be set at the setpoint.

3.5.4.4.9 With the HVAC system running, a freezestat trip input signal shall be simulated, at the device. HVAC system shutdown shall be verified. It shall be verified that a low temperature alarm is initiated. The freezestat shall be set at the setpoint. The HVAC system shall be restarted by manual restart and it shall be verified that the alarm returns to normal.

3.5.4.4.10 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 the Sequence 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 the smoke detector alarm is initiated. The detectors shall be reset. The HVAC system shall be restarted by manual reset, and it shall be verified that the alarm returns to normal.

3.5.4.4.11 Velocity setpoints shall be set for minimum and maximum flow and temperature setpoints for the heating/cooling dead band, for each VAV terminal unit. The actions of the controller, the operation of the damper, and the operation of heating shall be verified. It shall be verified that space temperature is maintained.

DIVISION 15 - MECHANICAL

SECTION 15990

TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for testing, adjusting and balancing of HVAC systems required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this specification to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standards:

S1.4 Sound Level Meters.

S1.11 Octave-Band and Fractional- Octave-Band Analog and Digital Filters.

1.2.2 American Society Of Heating, Refrigerating And Air Conditioning Engineers (ASHRAE) Publication:

111 Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air Conditioning and Refrigeration Systems.

1.2.3 Associated Air Balance Council (AABC) Publication:

MN-1 National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

1.2.4 National Environmental Balancing Bureau (NEBB) Publication:

01 Procedural Standards for Testing-Adjusting-Balancing of Environmental Systems.

1.2.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) Publication:

HVAC Systems - Testing, Adjusting and Balancing.

1.3 SUBMITTALS:

1.3.1 Testing and Balancing Reports:

1.3.1.1 Preliminary Report: Submit 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 HVAC Systems - Testing, Adjusting and Balancing Manual. 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 HVAC Systems - Testing, Adjusting and Balancing Manual, 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.

1.3.1.2 Final Report: Submit six copies of the final report on forms shown in AABC MN-1 or SMACNA HVAC Systems - Testing, Adjusting and Balancing Manual, within 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 fan powered variable air volume (VAV) box 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 and the VAV 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 boilers, 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 HVAC Systems - Testing, Adjusting and Balancing Manual.

1.3.2 Certificates: Qualification data shall be submitted 90 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.

1.4 GENERAL REQUIREMENTS: The Contractor shall select AABC MN-1, NEBB 01, SMACNA HVAC Systems - Testing, Adjusting and Balancing Manual 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. Sound level measuring equipment shall be rated in accordance with ANSI S1.4 and ANSI S1.11.

1.5 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 1.4, 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.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 GENERAL: Test, adjust, and balance HVAC systems as indicated on the plans and specified herein.

3.2 TESTING AND BALANCING: 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 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 1.4, 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.

3.2.1 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. Fire dampers shall be open. Fans shall be checked for correct direction of rotation and proper speed shall be verified.

3.2.2 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 1.4, 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 one horsepower, or if throttling results in no greater than an additional 1/3 horsepower 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.

3.2.3 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 1.4, GENERAL REQUIREMENTS. If a system has diversity, only the required quantity of wide open terminals shall be used to meet the design air flow.

3.2.4 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 1.4, 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.

3.2.5 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 1.4, GENERAL REQUIREMENTS. Flows shall be checked in all main risers and branches and at all heating and cooling coils, 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.

3.2.6 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 1.4, GENERAL REQUIREMENTS. If a system has diversity, only the required quantity of wide-open terminals shall be used to meet the design water flow. Four-pipe systems shall be considered as two two-pipe systems, and balanced separately.

3.2.7 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.

3.2.8 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.

3.2.9 Sound Level Testing: After the systems are properly tested, adjusted and balanced, sound levels shall be checked in accordance with the applicable provisions of AABC MN-1. Octave-band analysis and noise-criteria curve data shall be recorded on forms shown in AABC MN-1. All occupied areas including offices, living quarters, class rooms, and corridors shall be verified to be within the sound levels specified in Table I. Any areas not meeting the requirements of AABC MN-1 or the specifications shall be clearly indicated on the form and an explanation of all discrepancies shall be provided in test report.

TABLE I - SOUND LEVEL CRITERIA

Area	Criteria (Note 1)
Office Spaces	RC25-35(N)
Class Rooms	RC35-40(N)
Corridors	RC35-40(N)

Notes:
1) RC-Room Criteria, N-Neutral Spectrum as defined in 1995 ASHRAE Handbook-HVAC Applications, Chapter 43, "Sound and Vibration Control".

3.3 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.

DIVISION 16 – ELECTRICAL

16050	Electrical (Interior and Exterior with Expanded Part 3—Execution)
16400	Electrical, Service and Distribution (Up to 600 Volts)
16510	Interior Lighting (Fluorescent, High Intensity Discharge, Incandescent)
16520	Exterior Lighting (Aviation, Flood, Navigation, Roadway, Signal, Site, Sports Lighting)
16721	Addressable Fire Detection and Alarm System
16722	Remote Radio Transceiver System
16740	Voice and Data System
16775	Audio Visual Systems
16780	Community Antenna Television System

DIVISION 16 - ELECTRICAL

SECTION 16050

ELECTRICAL

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for accomplishment of electrical work required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standards:

C2	National Electric Safety Code.
C29.1	Electrical Power Insulators - Test Methods.
C29.2	Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type.
C62.41	Guide for Surge Voltages in Low-Voltage AC Power Circuits.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

B8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
B232	Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced (ACSR).
C94	Ready-Mixed Concrete.

1.2.4 Federal Specification (FS):

W-S-610	Splice Connectors.

1.2.5 Federal Standard (FStd):

595	Colors.

1.2.6 Institute of Electrical and Electronics Engineers (IEEE) Publication:

C57.13	Instrument Transformers.

1.2.7 National Electrical Manufacturers Association (NEMA) Publications:

AB 1	Molded Case Circuit Breakers and Molded Case Switches.
ICS 1	General Standards for Industrial Controls and Systems.
ICS 6	Enclosures for Industrial Controls and Systems.

LA 1	Surge Arresters.
MG 1	Motors and Generators.
WC 7	Cross-Linked- Thermosetting Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
WC 8	Ethylene-Propylene- Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
WD 1	Wiring Devices.

1.2.8 National Fire Protection Association (NFPA) Standards:

70	National Electrical Code (NEC).
72	National Fire Alarm Code (NFAC).

1.2.9 Underwriters Laboratories (UL) Publications:

1	Flexible Metal Conduit.
3	Flexible Nonmetallic Tubing for Electric Wiring.
5	Surface Metal Raceways and Fittings.
6	Rigid Metal Conduit.
20	General-Use Snap Switches.
44	Rubber-Insulated Wires and Cables.
50	Cabinets and Boxes.
62	Flexible Cord and Fixture Wire.
67	Panelboards.
83	Thermoplastic-Insulated Wires and Cables.
96	Safety Lightning Protection Components.
198D	Class K Fuses.
231	Power Outlets.
360	Liquid-Tight Flexible Steel Conduit.
467	Grounding and Bonding Equipment.
486A	Wire Connectors and Soldering Lugs for Use with Copper Conductors.
486B	Wire Connectors for Use with Aluminum Conductors.
489	Molded-Case Circuit Breakers and Circuit-Breaker Enclosures.

493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables.
498	Attachment Plugs and Receptacles.
508	Industrial Control Equipment.
514A	Metallic Outlet Boxes.
514B	Fittings for Conduit and Outlet Boxes.
514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
651	Schedule 40 and 80 Rigid PVC Conduit.
651A	Type EB and A Rigid PVC Conduit and HDPE Conduit.
719	Nonmetallic-Sheathed Cables.
773A	Non-industrial Photoelectric Switches for Lighting Control.
797	Electrical Metallic Tubing.
845	Motor Control Centers.
854	Service-Entrance Cables.
869	Service Equipment.
873	Temperature-Indicating and Regulating Equipment.
891	Dead-Front Switchboards.
943	Ground-Fault Circuit Interrupters.
1004	Electric Motors.
1242	Intermediate Metal Conduit.
1449	Transient Voltage Surge Suppressors.
1660	Liquid-Tight Flexible Nonmetallic Conduit.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation, Operation, and Maintenance Instructions: Submit manufacturer's written installation, operation, and maintenance instructions.

1.3.3 Shop Drawings: Submit shop drawings for proposed installation of new components and replacement of existing system components. Submit shop drawings for proposed additions and changes to electrical systems.

1.3.4 As-Built Drawings: Submit as-built drawings for installation of new components and replacement of existing system components. Submit as-built drawings for additions and changes to electrical systems.

1.3.5 Circuit Program: In addition to completing the circuit program on each panel door, submit a neatly printed or typewritten circuit program for each panel installed. Circuit programs shall include the building number, quarters number, breaker size and number, and panel identification.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified. In addition to the requirements below, circuit breakers, industrial control equipment, panelboards, and service equipment shall be the products of one manufacturer. All transformers shall also be the products of one manufacturer.

2.2 BUSWAYS AND FITTINGS: Busways and fittings shall conform to NEMA BU 1 and UL 857, and be the type and size indicated or as necessary to match the items being replaced.

2.3 CABLE AND WIRING:

2.3.1 Cable and Wiring, Interior, 600 Volts: Interior cable and wiring shall be rated not less than 600 volts and conform to UL 44, UL 62, UL 83, UL 493, UL 719, and UL 854 as appropriate for the application, and be the type and size indicated or as necessary to match the items being replaced.

2.3.2 Cable and Wiring, Exterior, 600 Volts: Exterior cable and wiring shall be rated not less than 600 volts and conform to UL 44, UL 83, UL 493, or UL 854 as appropriate for the application, and be the type and size indicated or as necessary to match the items being replaced. Other parts of cable systems such as splices and terminations shall be rated not less than 600 volts. Splices in wires No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to FS W-S-610, Type I, Class 1, Grade B, Style G. or Type II, Class 1 and the applicable requirements of UL 486A.

2.3.4 Cables, Grounding: Grounding cables shall be bare copper and conform to ASTM B8, soft-drawn, except where installed in conduit with associated phase conductors. Insulated cables installed in conduit with associated phase conductors shall be rated for not less than 600 volts be the same copper material, green color-coded, and insulated to match associated phase conductors.

2.3.5 Aluminum Coated-Steel Reinforced Cable: Aluminum coated-steel reinforced cable (ACSR) shall conform to ASTM B232 and be the size indicated or as necessary to match the items being replaced.

2.4 CABLE TRAYS: Cable trays shall conform to NEMA VE 1 and be the type and size indicated or as necessary to match the items being replaced.

2.5 CIRCUIT BREAKERS: Circuit breakers shall conform to NEMA AB 1 and UL 489 and be molded case type and the size indicated or as necessary to match the items being replaced.

2.6 CONDUIT AND FITTINGS: Conduit and fittings shall conform to UL 1, UL 3, UL 6, UL 360, UL 514B, UL 651, UL 651A, UL 797, UL 1242, or UL 1660 as appro-

priate for the application, and be the type and size indicated or as necessary to match the items being replaced.

2.7 CONNECTORS AND LUGS: Connectors and lugs shall conform to UL 486A or UL 486B as appropriate for the application, and be the type and size indicated or as necessary to match the items being replaced.

2.8 COVERS, OUTDOOR: Covers for outdoor ground fault circuit interrupter (GFCI) receptacles shall be horizontal or vertical mounting. Switch covers shall be vertical mounting. All covers shall be single-gang, weatherproof, corrosion resistant die cast aluminum, with self-closing lid, neoprene gaskets, baked-on gray enamel finish, and stainless steel mounting screws. Switch covers shall be equipped with weatherproof exposed control switch handles. Receptacle and switch covers shall be the type and size indicated or as necessary to match the items being replaced. Receptacle and switch covers shall be catalog numbers below or an approved equal.

Description	Raco Cat No	Leviton Cat No	Pass & Seymour Cat No
Vertical Mounting GFCI Receptacle Cover	5002	6196-VFS	4512
Horizontal Mounting GFCI Receptacle Cover	5028	6196-FS	4511
Vertical Mounting Switch Cover	5121		

2.10 ENCLOSURES: Enclosures shall be painted steel and conform to UL 50 and be the type and size indicated or as necessary to match the items being replaced.

2.11 FIRE HEAT DETECTION AND ALARM SYSTEM DEVICES: Refer to SECTION 16721, FIRE DETECTION AND ALARM SYSTEM for Fire Detection and Alarm Systems and SECTION 16722, REMOTE RADIO TRANSCEIVER SYSTEM for Fire Alarm Reporting Systems.

2.12 FUSE CUTOUTS AND FUSES: Primary-fuse cutouts shall be heavy-duty load-break, open type construction. Fuse ratings shall be equal to approximately 150 percent of transformer full-load ratings, and 100 percent of cable ratings for aerial to underground transitions which serve more than 1 transformer. Fuse cutouts shall be equipped with mounting brackets suitable for the indicated installations.

2.13 FUSES: Fuses shall conform to UL 198D and be the type and size appropriate for the application.

2.14 GROUND-FAULT CIRCUIT INTERRUPTERS:

2.14.1 Ground-Fault Interrupter Circuit Breakers: Ground-fault interrupter circuit breakers shall conform to UL 943 and be the size indicated or as necessary to match the items being replaced.

2.14.2 Ground-Fault Interrupter Receptacles: Ground-fault interrupter receptacles shall conform to NEMA WD 1, UL 498 and UL 943, and be the size indicated or as necessary to match the items being replaced. Ground-fault interrupter receptacles shall be 15 amp duplex receptacle with 20 amp feed-through, 125 volt, 2 pole, 3 wire, ivory, Class A, Group I, and Premium Specification Grade equipped with indicator lamp. Ground-fault interrupter receptacle listed below or approved equals.

Description	Rating	Leviton Cat No	Pass & Seymour Cat No

Duplex Receptacles	15A/125V	6198-HGI	1591-SHG
Duplex Receptacles	20A/125V	6398-HGI	2091-SHG

2.15 GROUND RODS AND CLAMPS: Ground rods shall be copper clad and a minimum size of 0.625 inch by 8 feet for 100 amp services and 0.75 inch by 10 feet for above 100 amp services. Ground wire shall be bare copper and a minimum size of No. 6 solid copper conductor for 100 amps and below an a minimum size of No. 4 solid copper conductor for above 100 amps. Ground rods, clamps and wire shall be sized in accordance with NFPA 70, Section 250 and UL 467.

2.16 GUYING MATERIALS: Guy wire shall be 7 strands. Guying wire and hardware shall be Class A, zinc-coated steel with a minimum breaking strength not less than 6000 pounds, except where two or more guys are used to provide the required strength.

2.17 INSULATORS: Insulators for use on primary distribution system shall conform to ANSI C29.1, C29.2, C29.4, C29.5, C29.6, or C29.7 as appropriate for the application.

2.18 INDUSTRIAL CONTROL EQUIPMENT: Industrial control equipment shall conform to NEMA ICS 1, NEMA ICS 6, and UL 508 and be the type and size indicated on the plans.

2.19 LIGHTING FIXTURES:

2.19.1 Interior Lighting Fixtures: Refer to SECTION 16510, INTERIOR LIGHTING FIXTURES.

2.19.2 Exterior Lighting Fixtures: Refer to SECTION 16520, EXTERIOR LIGHTING FIXTURES.

2.20 PANELBOARDS:

2.20.1 Panelboards: Panelboards for other than residential applications shall conform to NEMA ICS 1, UL 50, UL 67, UL 869, and UL 891 and be the size indicated or as necessary to match the items being replaced. Panelboards shall be dead front construction with copper bus, have capabilities for bolt-on and plug-on circuit breakers, and all circuits shall have full size circuit breakers. All panelboards shall have a main circuit breaker unless specified on plans. All panelboards 400 amps or larger shall be a Square D I-line, Cutler Hammer EE-line, or approved equal.

2.22 MOTORS, AC, FRACTIONAL AND INTEGRAL HORSEPOWER (500 HP AND SMALLER): NEMA MG 1 and UL 1004 for motors and NEMA MG 10 for energy management selection of polyphase motors.

2.22.1 Horsepower Rating: The horsepower rating 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.

2.22.2 Motor Efficiencies: All permanently wired polyphase motors of 1 hp or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors not indicated or specified elsewhere to be standard or high efficiency type should be determined on the basis of expected operating hours.

Minimum Motor Efficiencies

Horsepower	kW	Standard Efficiency	High Efficiency
1.0	0.746	77.0	85.5
1.5	1.12	78.5	85.5
2.0	1.49	78.5	85.5
3.0	2.24	78.5	88.5
5.0	3.73	82.5	88.5
7.5	5.6	84.0	90.0
10.0	7.46	85.5	90.0
15.0	11.2	85.5	91.0
20.0	14.9	87.5	92.0
25.0	18.7	88.5	92.0
30.0	22.4	88.5	92.0
40.0	29.8	88.5	92.0
50.0	37.3	89.0	92.5

2.22.3 Motor Controls: Motor control shall conform to NEMA ICS 1, NEMA ICS 6, UL 508, and UL 845 and be the type and size indicated on the plans.

2.23 OUTLET BOXES AND FITTINGS:

2.23.1 Metallic Outlet Boxes and Fittings, Exterior: Metallic outlet boxes and fittings shall conform to UL 514A and UL 514B as appropriate for the application, and be the type and size indicated or as necessary to match the items being replaced. Outlet boxes for outdoor ground fault interrupter shall be surface mounted, single-gang, weatherproof, corrosion resistant die-cast aluminum with 1/2-inch hubs, four mounting lugs, and baked-on gray enamel finish. Outlet boxes shall be mounted with four No. 8 by 1-1/2 inch zinc-plated screws. Expansion anchors shall be used for masonry surfaces. Outlet boxes shall be a FS type box when used with a metallic conduit system. When back wiring from NM cable the standard weatherproof, corrosion resistant die-cast aluminum with 1/2-inch inside hubs, four mounting lugs, and baked-on gray enamel finish will be used.

2.23.2 Metallic Outlet Boxes and Fittings, Interior: Metallic outlet boxes and fittings shall conform to UL 514A and UL 514B as appropriate for the application, and be the type and size indicated or as necessary to match the items being replaced. All metallic boxes shall be 4 inch square and/or octagon metallic boxes with eccentric 1/2 and 3/4 knockouts. All metallic boxes installed in finished walls and/or ceilings shall be equipped with plaster rings where appropriate.

2.23.3 Nonmetallic Outlet Boxes: Nonmetallic outlet boxes, flush-device boxes, and covers shall conform to UL 514C, and be the type and size indicated or as necessary to match the items being replaced. All nonmetallic boxes shall have a minimum fire rating of 2 hours and be fiberglass construction, PVC type outlet boxes will not be allowed.

2.24 READY-MIXED CONCRETE: Ready-mixed concrete shall conform to ASTM C94 and have a compressive strength of 4,000 psi at 28 days.

2.25 RECEPTACLES:

2.25.1 Convenience and Power Receptacles: Receptacles shall conform to UL 498 and NEMA WD 1, and be the type, size, and color appropriate for the application, as indicated or as necessary to match the items being replaced. Power receptacles shall conform to UL 231 and NEMA WD 1, and be the type, size, and color appropriate for the application, as indicated or as necessary to match the items being replaced. Convenience receptacles shall be back and/or side

wired, 2-pole, 3-wire grounding type, and Premium Specification Grade. Power receptacles shall be back and/or side wired, 3-pole, 3-wire, or 3-pole, 4-wire grounding type, as appropriate for the application. Receptacles shall be the following Leviton or Pass and Seymour catalog numbers or approved equals:

Description	Rating	Leviton Cat No	Pass & Seymour Cat No
Single Receptacles	15A/125V	5261	5261
Single Receptacles	15A/250V	5616	5671
Single Receptacles	20A/125V	5361	5361
Single Receptacles	20A/250V	5461	5871
Duplex Receptacles	15A/125V	5262	5262
Duplex Receptacles	20A/125V	5362	5362
Duplex Receptacles (Dual Voltage)	20A/125-250V	5844	9392-HG
Flush Mount Power Receptacles	20A/125-250V	5823	5871
Flush Mount Power Receptacles	30A/125-250V	5207 or 278	3853 or 5744
Flush Mount Power Receptacles	30A/125-250V	5372	5930
Flush Mount Power Receptacles	50A/125-250V	5006 or 279	3008 or 5754
Surface Mount Power Receptacles	30A/125-250V	5054-2 or 55054	5784
Surface Mount Power Receptacles	30A/125-250V	5376	
Surface Mount Power Receptacles	50A/125-250V	5050 or 55050	3826 or 5785

2.27.2 Isolated Ground Receptacles: Isolated ground receptacles shall conform to UL 498 and NEMA WD 1, and be the type, size, and color appropriate for the application, as indicated or as necessary to match the items being replaced. Receptacles shall be premium specification grade, orange high-strength nylon face positively identifies isolated ground system. Wall plates shall be orange and with the words isolated ground at top of plate. Convenience receptacles shall be 2-pole, 3-wire grounding type, and Premium Specification Grade. Receptacles shall be the following Leviton or Pass and Seymour catalog numbers or approved equals:

Description	Rating	Leviton Cat No	Pass & Seymour Cat No
Single Receptacles	15A/125V	5261-IG	IG5266-SS
Single Receptacles	20A/125V	5361-IG	IG5366-SS
Duplex Receptacles	15A/125V	5262-IG	IG6200-HG
Duplex Receptacles	20A/125V	5362-IG	IG9300-HG

2.27.3 Surge Suppressor Receptacles: Surge suppressor receptacles shall conform to UL 231, UL 1449 and NEMA WD 1, and be the type, size, and color appropriate for the application, as indicated or as necessary to match the items being replaced. Surge suppressor receptacles shall be 2-pole, 3-wire grounding type, back or side wire and Premium Specification Grade. Surge suppressor receptacles shall provide protection against surges of not less than 80 joules in all three modes (hot to neutral hot to ground and neutral to ground) with a response time of not less than 1 nanosecond, protection activation voltage not more than 150 volts RMS, provide RFI and EMI noise filtration at an average 7:1 reduction from 500 kHz to 30 mHz and in an isolated grounding version for further noise protection. Receptacles shall be the following Leviton or Pass and Seymour catalog numbers or approved equals:

Description	Rating	Leviton Cat No	Pass & Seymour Cat No
Single Twist-Lock Receptacles	15A/125V		4710
Single Twist-Lock Receptacles	20A/125V (Iso Type)		IG4710
Duplex Receptacles	15A/125V		6262
Duplex Receptacles	20A/125V		6362
Duplex Receptacles	15A/125V (Iso Type)		IG6262
Duplex Receptacles	20A/125V (Iso Type)		IG6362

2.28 SERVICE EQUIPMENT: Service equipment shall conform to NEMA ICS 1, UL 50, UL 869, and UL 891 and be the type and size indicated or as necessary to match the items being replaced.

2.29 SURFACE METAL RACEWAYS AND FITTINGS: Surface metal raceways and fittings shall conform to UL 5 and be the type and size indicated or as necessary to match the items being replaced. Surface metal raceways and fittings shall be painted to match the surfaces on which they are installed.

2.30 SURGE ARRESTERS:

2.30.1 Primary Surge Arresters: Primary surge arresters shall conform to NEMA LA 1 and UL 96. Surge arresters shall be metal-oxide type and installed at all aerial-to-under-ground and transformer connections. Surge arresters shall be equipped with mounting brackets suitable for the indicated installations.

2.30.2 Secondary Surge Arresters: Surge secondary arresters shall conform to ANSI C62.41 and UL 96 approved and be design to protect 2 and 3 pole 3 or 4 wire electrical service. For inside or outside installation, bracket or knockout mounted. The arrester shall be design for the protection against damage by lightning rated for 650 volts. Surge arresters shall be installed at all panelboards and transformer connections. Surge arresters shall be equipped with mounting brackets suitable for the indicated installations.

2.31 SWITCHES: Switches, dimmers, occupancy sensors, and fan controls shall conform to UL 20 and NEMA WD 1, and be the type, size, color appropriate for the application, as indicated or as necessary to match the items being replaced. Switches shall be quiet type, side and/or back wired and Premium Specification Grade. Dimmers and fan controls shall be rotary type, push-on and push-off (except the fan control switch) and Specification Grade. Occupancy sensors shall be designed to automatically turn lights on when its viewing area is entered, and turn lights off when no presence is detected for up to 15 minutes. The sensor shall have a viewing angle of 180 degrees and up to 40 feet nominal viewing range and be equipped with a override switch. Switches, occupancy sensors and dimmers shall be the following Leviton or Pass and Seymour catalog numbers or approved equals.

Description	Rating	Leviton Cat No	Pass & Seymour Cat No
Single Pole Switch	15A/120-277V	1201	15AC1
Double Pole Switch	15A/120-277V	1202	20AC1
3-Way Switch	15A/120-277V	1203	15AC3
4-Way Switch	15A/120-277V	1204	15AC4
Single Pole Switch	15A/120-277V	1221	15AC1
Double Pole Switch	15A/120-277V	1222	20AC1
3-Way Switch	15A/120-277V	1223	15AC3

4-Way Switch	15A/120-277V	1224	15AC4
Single Pole Incandescent Dimmer	660W/120V	6681	90610-I
Single Pole Incandescent Dimmer	1000W/120V	61000	91000-I
3-Way Incandescent Dimmer	660W/120V	6683	90613-I
3-Way Incandescent Dimmer	1000W/120V	61000-3W	91003-I
Single Pole Fluorescent Dimmer	1000W/120V	6677	93420-I
Occupancy Sensing Control Switch	600/1200W/120-277V		OSC3000-I
Single Pole Fan Speed Control	8A Max/120V	6677	94801-I
Single Pole Fan Speed Control	12A Max/120V	6677	94121-I
Dual Control Light, Fan (No Noise)	12A Max/120V		94315-I

2.32 THERMOSTATS AND CONTROL BASES: Thermostats and control bases shall conform to UL 873 and be compatible with the type of equipment being controlled or as necessary to match the items being replaced. All bases shall have a fan ON-OFF switch and a HEAT-OFF-A/C switch.

2.34 WALL PLATES: Wall plates for receptacles and switches shall be single, double, triple, or quadruple gang; brushed stainless steel as appropriate for the application, as indicated or as necessary to match the items being replaced.

PART 3 EXECUTION

3.1 GENERAL: Perform all electrical work indicated on the plans and specified herein.

3.2 INSTALLATION:

3.2.1 Installation for other than Family Housing Residential Installation: Accomplish electrical work in accordance with ANSI C2, NFPA 70, approved shop drawings, any applicable manufacturer's written installation instructions, and the requirements herein. All interior wiring shall be run in conduit and conductors shall be copper. Service entrance or feeder conductors shall be in conduit and copper. Exterior overhead triplex or quadruplex service drops conductors shall be aluminum.

3.3 BOXES AND SUPPORTS: Boxes shall be provided in the wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways, 4-inch by 4-inch nominal 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. Large size boxes shall be NEMA 1 or 3R as indicated. Boxes in other locations shall be sheet steel. In partitions of light steel construction bar hangers with 1-inch long studs, mounted between metal wall studs or metal stud "C" brackets snapped on and tab-locked to metal wall studs, shall be used to secure boxes to the building structure. When "C" brackets are used, additional box support shall be provided on the side of the box opposite the brackets. The edges of boxes for electrical devices shall be flush with the finished surfaces in gypsum and plasterboard installations. Boxes for mounting lighting fixtures shall be not less than 4-inches square except smaller boxes may be installed as required by fixture configuration, as approved. 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 flush with the top of a block to minimize cutting of blocks, and boxes shall be located horizontally to avoid cutting webs of block. Indicated elevations are approximate. Unless otherwise indicated, boxes for wall switches shall be mounted 48 inches and receptacle 12 inches above finished floors. Cast-metal boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. 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 screws 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. 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. Cast-metal boxes with 0.0937 inch wall thickness are acceptable. 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 24 inches from the box. Penetration of more than 1.5 inches into reinforced-concrete beams or more than 0.75 inch into reinforced-concrete joists shall avoid cutting any main reinforcing steel. Pull boxes of not less than the minimum size required by the NFPA 70 shall be constructed of aluminum or galvanized sheet steel, except where cast-metal boxes are required in locations specified above. Boxes shall be furnished with screw-fastened covers. 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.

3.4 WIRING METHODS:

3.4.1 General Requirements: Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid zinc-coated steel conduit, electrical metallic tubing (EMT), and/or intermediate metal conduit.

3.4.2 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 0.5 inch. 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 may be installed only within buildings. Electrical metallic tubing may be installed in concrete and grout in dry locations. EMT will not be installed in damp or wet locations. 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. 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 6 inches away 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 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.

3.4.2.1 Below Slab-on-Grade or in the Ground: All 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 0.010-inch thick pipe-wrapping plastic tape applied with a 50-percent

overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

3.4.2.2 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 70 definitions.

3.4.2.3 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 entirely freed of obstructions or shall be replaced.

3.4.2.4 Supports: Metallic conduits and tubing shall be securely and rigidly fastened in place at intervals of not more than 10 feet and within 3 feet of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, or ceiling trapeze. C-clamps or beam clamps shall have strap or rod-type retainers. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structures, but no load shall be applied to joist bridging. Fastenings 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. Holes cut to a depth of more than 1.5 inches in reinforced concrete beams or to a depth of more than 0.75 inch in concrete joists shall avoid cutting the main reinforcing bars. Holes not used shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Conduit shall not be supported using wire or nylon ties. Raceways shall be installed as a complete system and be independently supported from the structure. Upper raceways shall not be the support of lower raceways. Supporting means will not be shared between electrical raceways and mechanical piping or ducts and shall not be fastened to hung ceiling supports. Conduits shall be fastened to all sheet-metal boxes and cabinets with two locknuts where required by the 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. A pull wire shall be inserted in each empty raceway in which wiring is to be in-stalled by others if the raceway is more than 50 feet in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 150 feet in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 200-pound tensile strength. Not less than 10 inches of slack shall be left at each end of the pull wire. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

3.4.2.6 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 50 feet for 0.5 inch and 0.75 inch sizes, and 100 feet for 1.0 inch or larger sizes, and shall not contain more than two 90-degree bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radius of bends in conduits of 1.0 inch size or larger shall be not less than ten times the nominal diameter.

3.4.3 Cables and Conductors: All conductors shall be copper. Wire connectors of insulating material or solderless pressure connectors properly taped shall be utilized for all splices.

3.4.3.1 Sizes: All sizes are based on copper conductors, unless otherwise 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 100 feet long from panel or load center shall be a minimum 10 AWG. Longer distances shall follow NEC. 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.

3.4.3.1.1 The conductor sizes are based on the use of TW insulation for conductors smaller than No. 1/0 AWG and THW insulation for conductors No. 1/0 and larger, except where otherwise indicated. All wiring shall be based on a maximum 75 degree C. calculations, reduce to 60 degree C. if connected devices are only rated for 60 degree C.

3.4.3.1.2 Higher temperature rated conductors shall be permitted to be used, if the UL tested temperature ratings for which the equipment in the circuit is marked are not exceeded.

3.4.3.1.3 Conductor sizes for nonlinear loads shall be based on the use of minimum 75 degrees C. insulated conductors for branch circuits and feeders.

3.4.3.2 Power Conductor Identification: All phase conductors shall be identified by color-coding. The color of the insulation on the phase conductors of different voltage systems shall be as follows:

3.4.3.2.1 120/208 volt, 3-phase: black, red, and blue.

3.4.3.2.3 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 3.0 inches of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

3.4.3.3 Control Conductor Identification: Control 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.

3.5 GROUNDING: A green ground wire shall be furnished regardless of the type of conduit. All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Insure that all metallic raceways and grounding conductors are actually 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.

3.6 RECEPTACLES: Single and duplex receptacles shall be as described on plans or here within. The rating shall be 15 or 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 the UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided everywhere as required by the NFPA 70 and in addition all the following receptacle locations; exterior including those on roofs, bathrooms with showers, shops, hangars, and garages.

3.7 SWITCHES: Switches shall be of the totally enclosed tumbler type. Switch handle and wall plate color shall harmonize with the color of the respective wall. 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. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be red.

3.8 WALL 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, or cast-metal. Plates on finished walls shall be of satin finish corrosion resistant steel or of satin finish chromium plated brass. 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 0.0625 inch. 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.

3.9 MOTOR CONTROL: Each motor or group of motors requiring a single control 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 0.125 hp or larger shall be provided with thermal-overload protection. All polyphase motors 0.75 hp and above shall be equipment with an electronic monitoring and control device to monitor loss-of-phase, phase-reversal, or low voltage by automatically shutting down the polyphase motor. In addition the 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 horsepower rating. 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.

3.10 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.

3.11 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 Contractor furnished and installed under this section of the specifications. Connections shall comply with the applicable requirements of paragraph WIRING METHODS. Flexible conduits 6 feet or 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.

3.12.1 Motors and Motor Control: Control equipment furnished under this section of the specifications, and shown on the drawings, shall be connected under this section of the specifications unless shown or specified otherwise. Except as otherwise specifically noted, automatic-control wiring, signaling, and protective devices are not included in this section of the specifications, but shall be Contractor furnished and installed under other sections of the specifications. Control wiring not shown on the drawings shall be Contractor furnished under the other sections of the specifications.

3.12.2 Auxiliary Devices: All auxiliary devices such as tie bars, cable rings, etc. which are not shown but are required for a high grade installation shall be provided by the Contractor.

3.13 REPAIR OF EXISTING WORK: The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved, at no additional cost to the Government.

3.14 TESTS: After the interior-wiring-system 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 of this specification. The Contractor shall furnish all instruments and qualified personnel required to perform the tests, and the Government will furnish the necessary electric power.

DIVISION 16 - ELECTRICAL

SECTION 16400

ELECTRICAL SERVICE AND DISTRIBUTION (UP TO 600 VOLTS)

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation of electrical service and distribution (up to 600 volts) components required in this contract.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. The publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standards:

C2	National Electric Safety Code.
C29.1	Test Methods for Electrical Power Insulators.
C29.2	Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type.

1.2.2 American Society for Testing and Materials (ASTM) Publications:

B232	Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced (ACSR).
C94	Ready-Mixed Concrete.

1.2.4 Federal Standard (FStd):

595	Colors.

1.2.5 National Electrical Manufacturers Association (NEMA) Publications:

AB 1	Molded Case Circuit Breakers and Molded Case Switches.
LA 1	Surge Arresters.
TC 2	Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC 80).
WC 7	Cross-Linked- Thermosetting Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
WC 8	Ethylene-Propylene- Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

1.2.6 National Fire Protection Association (NFPA) Standard:

70	National Electrical Code (NEC).

1.2.7 Underwriters Laboratories (UL) Publications:

6	Rigid Metal Conduit.
50	Cabinets and Boxes.
67	Panelboards.
83	Thermoplastic-Insulated Wires and Cables.
486A	Wire Connectors and Soldering Lugs for Use with Copper Conductors.
489	Molded-Case Circuit Breakers and Circuit-Breaker Enclosures.
493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables.
651	Schedule 40 and 80 Rigid PVC Conduit.
854	Service-Entrance Cables.
869	Service Equipment.
891	Dead-Front Switchboards.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation, Operation and Maintenance Instructions: Submit manufacturer's written installation, operation and maintenance instructions.

1.3.3 Shop Drawings: Submit shop drawings for proposed installation of new components and replacement of existing system components. Submit shop drawings for proposed additions and changes to electrical utilities systems.

1.3.4 As-Built Drawings: Submit as-built drawings for installation of new components and replacement of existing system components. Submit as-built drawings for additions and changes to electrical utilities systems.

1.3.5 Transformer Record Card: Complete and submit 2 copies of Transformer Record Card (AFZN-PW Form 629) for each transformer installed in this contract.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ALUMINUM COATED-STEEL REINFORCED CABLE: Aluminum coated-steel reinforced cable (ACSR) shall conform to ASTM B232 and be the size indicated or as necessary to match the items being replaced.

2.3 CABLE AND WIRING: Cable and wiring shall conform to UL 83, UL 493, UL 719, or UL 854, as appropriate for the application, and the type and size indicated or as necessary to match the items being replaced.

2.4 CIRCUIT BREAKERS: Circuit breakers shall be molded case type and conform to UL 489 and NEMA AB 1, and be the size indicated or as necessary to match the items being replaced.

2.5 CONDUIT AND FITTINGS: Conduit and fittings shall conform to UL 1, UL 6, UL 651, UL 797, or NEMA TC 2, as appropriate for the application, and the type and size indicated or as necessary to match the items being replaced.

2.6 CONNECTORS AND LUGS: Connectors and lugs shall conform to UL 486A, as appropriate for the application, and the type and size indicated or as necessary to match the items being replaced.

2.7 FUSE CUTOUTS AND FUSES: Primary-fuse cutouts shall be heavy duty load-break, open type construction. Fuse ratings shall be equal to approximately 150 percent of transformer full-load ratings, and 100 percent of cable ratings for aerial-to-underground transitions which serve more than 1 transformer. Fuse cutouts shall be equipped with mounting brackets suitable for the indicated installations.

2.9 INSULATORS: Insulators for use on primary distribution system shall conform to ANSI C29.1, C29.2, C29.4, C29.5, C29.6, or C29.7, as appropriate for the application, and the type and size indicated or as necessary to match the items being replaced.

2.11 PANELBOARDS:

2.11.2 Panelboards: Panelboards for other than residential applications shall conform to UL 50, UL 869 and UL 891, and be the type and size indicated or as necessary to match the items being replaced.

2.13 READY-MIXED CONCRETE: Ready-mixed concrete shall conform to ASTM C94 and have a compressive strength of 4,000 psi at 28 days.

PART 3 EXECUTION

3.1 GENERAL: Install electrical service and distribution (up to 600 volts) components as specified herein.

3.2 INSTALLATION: Accomplish electrical work in accordance with ANSI C2 for heavy loading condition, NFPA 70, any applicable manufacturer's written installation instructions, approved shop drawings, and the requirements herein. All interior wiring shall be run in conduit and conductors shall be copper. Service entrance or feeder conductors shall also be in conduit and copper. Overhead primary service conductors shall be ACSR.

3.4 PREVENTION OF CORROSION: All metallic materials shall be protected against corrosion.

3.5 PLASTIC CONDUIT: Conduit and fittings shall be free, within commercial tolerances, of objectionable lines, striations, bubbles, welds, and other manufacturing defects that would impair the service of the conduit. The bore of the conduit shall be straight and circular in cross section with smooth interior surfaces free from obstructions and rough and flaky areas. The conduit and fittings shall be free from all substances that injuriously affect any wire or cable covering such as is used on rubber-covered wire, polychloroprene-sheathed cable, weatherproof wire, and lead- or lead-alloy-covered ca-

ble. The conduit and fittings shall be corrosion-resistant and not adversely affected by chewing insects, gnawing rodents, acids, alkalis, salts, bacteria, and other organic matter that would normally be encountered on the ground. The conduit length for each size shall be the length that is standard with the manufacturer with a permissible tolerance of 1/4-inch per 10-foot length. Bends, elbows, and other fittings shall be capable of freely passing a ball that is 1/4-inch less in diameter than the nominal bore of the conduit. Fittings shall be of a type especially made for use with plastic conduit for electrical service. Conduit and fittings shall be capable of being joined, by means of a solvent welding cement, so as to provide a watertight and rootproof joint. Sections cut from the conduit shall be calipered for wall thickness.

DIVISION 16 - ELECTRICAL

SECTION 16510

INTERIOR LIGHTING

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation of interior lighting required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 National Fire Protection Association (NFPA) Standard:

70	National Electrical Code (NEC).

1.2.2 Underwriters Laboratories (UL) Publications:

496	Edison-Base Lampholders
1570	Fluorescent Lighting Fixtures.
1571	Incandescent Lighting Fixtures.
1572	High Intensity Discharge Lighting Fixtures.
1574	Track Lighting Systems.

1.2.3 U.S. Army Corps of Engineers Standard Detail:

40-06-4	Lighting Fixtures.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: Submit color samples for selection of colors.

1.3.3 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.4 Shop Drawings: Submit shop drawings for proposed installation of new components.

1.3.5 As-Built Drawings: Submit as-built drawings for installation of new components.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 INCANDESCENT LIGHTING FIXTURES: Incandescent lighting fixtures shall conform to UL 495 or UL 1571 (as appropriate) and U.S. Army Corps of Engineers Standard Detail 40-06-04, Type 100 Series. Incandescent lighting fixtures shall be the type and size indicated, or which match the fixtures being replaced. Fixtures shall be enclosed and gasketed and/or suitable for use in wet locations as indicated, or as required for the installation. Fixtures shall be supplied with the lamps indicated.

2.3 FLUORESCENT LIGHTING FIXTURES: Fluorescent lighting fixtures shall conform to UL 1570 and U.S. Army Corps of Engineers Standard Detail 40-06-04, Type 200 Series. Fluorescent lighting fixtures shall be the type and size indicated, or which match the fixtures being replaced. Fixtures shall be enclosed and gasketed and/or suitable for use in wet locations as indicated, or as required for the installation. Fixtures shall be supplied with a T-8 34 watt 3,500K type lamps. Fixtures shall have energy conserving electronic T-8/12 type ballast. All fluorescent lighting fixtures with lens required shall be crystal clear, 100 percent virgin acrylic and shall be .125 inch thick and shall have a conical prism pattern. All fluorescent lighting fixtures shall have a minimum 65 percent efficiency factor. All fluorescent lighting fixtures installed in unheated and/or temperatures below 55 degrees shall have a low temperature ballast and have full fluorescent watt lamps installed.

2.4 HIGH INTENSITY DISCHARGE LIGHTING FIXTURES: High intensity discharge lighting fixtures shall conform to UL 1572 and U.S. Army Corps of Engineers Standard Detail 40-06-04, Type 300 Series. High intensity discharge lighting fixtures shall be the type and size indicated, or which match the fixtures being replaced. Fixtures shall be enclosed and gasketed and/or suitable for use in wet locations as indicated, or as required for the installation. Fixtures shall be supplied with the lamps indicated.

PART 3 EXECUTION

3.1 GENERAL: Install interior lighting as indicated on the plans and specified herein.

3.2 INSTALLATION: Install interior lighting in accordance with NFPA 70, approved shop drawings, any applicable manufacturer’s written installation instructions, and the requirements herein.

DIVISION 16 - ELECTRICAL

SECTION 16520

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation of exterior lighting required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.2 National Fire Protection Association (NFPA) Standard:

70	National Electrical Code (NEC).

1.2.3 Underwriters Laboratories (UL) Publications:

844	Electric Lighting Fixtures for Use in Hazardous (Classified) Locations.
1570	Fluorescent Lighting Fixtures.
1571	Incandescent Lighting Fixtures.
1572	High Intensity Discharge Lighting Fixtures.

1.2.4 U.S. Army Corps of Engineers Standard Details:

40-06-4	Lighting Fixtures.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Samples: Submit color samples for selection of colors.

1.3.3 Installation Instructions: Submit manufacturer's written installation instructions.

1.3.4 Shop Drawings: Submit shop drawings for proposed installation of new components.

1.3.5 As-Built Drawings: Submit as-built drawings for installation of new components.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

PART 3 EXECUTION

3.1 GENERAL: Install exterior lighting as indicated on the plans and specified herein.

3.2 INSTALLATION: Install exterior lighting in accordance with NFPA 70, approved shop drawings, manufacturer's written installation instructions, and the requirements herein.

DIVISION 16 - ELECTRICAL

SECTION 16721

ADDRESSABLE FIRE DETECTION AND ALARM SYSTEM

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation of an addressable fire detection and alarm system (FDAS) required in this contract.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 National Fire Protection Association (NFPA) Standards:

70	National Electrical Code (NEC).
72	National Fire Alarm Code.
90A	Installation of Air Conditioning and Ventilating Systems.

1.2.2 Underwriters Laboratories (UL) Publications:

1	Flexible Metal Conduit.
5	Surface Metal Raceways and Fittings.
6	Rigid Metal Conduit.
38	Manually-Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems.
50	Enclosures for Electrical Equipment.
83	Thermoplastic-Insulated Wires and Cables.
217	Single and Multiple Station Smoke Detectors.
268	Smoke Detectors for Fire Protective Signaling Systems.
268A	Smoke Detectors for Duct Application.
467	Grounding and Bonding Equipment.
514A	Metallic Outlet Boxes.
514B	Fittings for Conduit and Outlet Boxes.
521	Heat Detectors for Fire-Protective Signaling Systems.
797	Electrical Metallic Tubing.
864	Control Units for Fire-Protective Signaling Systems.
1971	Signaling Devices for the Hearing Impaired.

Fire Protective Equipment Directory.

1.3 SUBMITTALS: Prior to submitting the contract submittals the Contractor's QCM shall review, check, and approve all submittals. This requirement is in addition to the standard submittal process specified in SECTION 01300, SUBMITTALS.

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation, Operation, and Maintenance Instructions: Submit manufacturer's written installation, operation, and maintenance instructions.

1.3.3 Shop Drawings: Submit shop drawings showing the proposed installation of the fire detection and alarm system. Shop drawings shall include system wiring schematic and fire alarm panel wiring schematic. The system wiring schematics shall be color coded and include the device connections, device model and part number.

1.3.3.1 Product data for fire alarm system components including dimensioned plans, sections, and elevations showing minimum clearances, installed features and devices, and list of materials.

1.3.3.2 Wiring diagrams from manufacturer differentiating between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Include drawings indicating components for both field and factory panel wiring. Include a unique numbering system for all terminations and splices.

1.3.3.3 Shop drawings shall include detailed drawings of annunciator and zone designations.

1.3.3.4 Calculations for battery capacity for both alarm and supervisory modes.

1.3.3.5 Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with the referenced standards.

1.3.3.6 Voltage drop calculations for alarm circuits shall be made, and compared to the minimum voltage required for indicating devices to work. Wire sizes shall be increased accordingly.

1.3.4 Qualifications: Submit evidence of work experience, training, and certification for the company and employees that will be performing the work in this contract in accordance with paragraph 1.4, QUALIFICATIONS.

1.3.5 Spare Parts: Submit a list of the manufacturer's recommended spare parts for the system.

1.3.6 Test Reports: Submit test reports for the tests required in paragraphs 3.10 and 3.11.

1.3.7 As-Built Drawings: Submit as-built drawings for all work performed under this section.

1.4 QUALIFICATIONS:

1.4.1 "Fire Detection and Alarm System Contractor" shall have a minimum of 2 years experience in the installation and maintenance of electronic fire detection and alarm systems. Submit evidence of this experience.

1.4.2 "Fire Alarm Technicians" installing any fire detection and alarm devices and/or making-up any device wiring connections, shall have a minimum of 5 years experience in the installation, troubleshooting, field repair, and maintenance of electronic fire detection and alarm systems and/or radio transceiver systems. The installer technician shall be factory trained in using specialized test equipment necessary to perform the required testing in this contract. Submit evidence of this experience and training.

1.4.3 "Electricians" installing electrical raceways, junction boxes, supports, or pulling fire detection and alarm wiring shall be certified by the Contractor and approved by the Contractor's QCM. The personnel shall be a "Journeyman Electrician" with a minimum of 4 years experience in the electrical field, if any "Electrical Apprentices" are used, they shall be under the supervision of a journeyman electrician and all electrical installers shall be under the direct supervision of a "Master Electrician" and/or "Quality Control Manager" (QCM) during all phases of construction. Submit evidence of this experience and training.

1.4.4 "Quality Control Manager" performing quality control shall have a minimum of 5 years experience in the installation, troubleshooting, field repair, and maintenance of all types of electronic fire detection and alarm systems, and shall hold a certification level as an Engineering Technician (ET) by National Institute for Certification in Engineering Technologies (NICET) or a registered Electrical Engineer (EE) who has had at least 2 years of experience in design of these systems. Qualifications with certified verification or license number of the registration or certification, or 10 years experience in this field with certified factory training for fire detection and alarm systems and radio transceivers. Submit evidence of this experience, certification, and training.

1.5 TRAINING FOR GOVERNMENT PERSONNEL:

1.5.1 Training Course: Furnish a factory certified and qualified instructor to conduct a training courses for operating staff and/or fire detection and alarm equipment service contractor personnel performing work at the Fort Riley Main Fire Station, Building 5000, or as designated by the COR. The class room and field training will be on the new Contractor installed system(s). The training period shall consist of a minimum of 2 training days 4 hours per day for operation and minimum of 2 training days 4 hours per day for preventative maintenance and troubleshooting and repair procedures. The training shall start after all the systems are functionally completed but prior to the final acceptance test. The class room and field instructions shall cover operation, preventative maintenance, troubleshooting and repair procedures contained in the manufacturer's operating and maintenance instructions. All training shall be scheduled with a minimum of 10 days notice provided to the Government prior to the start of training. All training shall be coordinated with the COR prior to finalizing the training schedule.

1.5.2 Operating and Maintenance Instructions: Furnish a sufficient quantity of final approved copies of the complete operating and maintenance instructions 14 calendar days prior to training. The operating and maintenance instructions shall outline operating and maintenance procedures and contain a troubleshooting guide. The operating and maintenance instructions will be used for class and field training.

1.5.3 Training Equipment: Furnish all fire detection and alarm training equipment required to conduct the training course.

1.6 SPARE PARTS: Submit a list of the manufacturer's recommended spare parts for all systems. Supply a minimum of 2 percent of all fire detection and alarm devices installed to include the manufacturer's recommended spare parts, at the completion of the contract. Three complete sets of all special equipment needed to remove, inspect and/or repair the system shall be supplied to the Government at no additional cost. Use Government form DD 1348-1 for turn in all spare parts. Turn-in all spare parts and special equipment to PW Operations and Maintenance Division, with the COR present. All parts being turned over to the Government shall be cataloged by nomenclature, part number, quantity and cost. The DD 1348-1 shall be signed by the Contractor and Government personnel receiving the material.

1.7 WARRANTY SERVICE MAINTENANCE: Maintain the fire detection and alarm system for two years from the date of acceptance by the Government. Be on site to repair the fire detection and alarm system within 8 hours after notification from the Contracting Officer, or as further delegated and the system shall be operational within 24 hours. Notification of the systems status shall be telephonically transmitted to the Fort Riley Fire Main Station prior to departing from the site. Submit a report of the cause of the failure and the required parts and man-hours to repair the system within 10 days after the completion to the COR.

1.8 TEST EQUIPMENT: Suggest the Contractor use the following test equipment to perform the required tests in this section.

1.8.1 Digital Sound Level Meter: Handheld; range of 30-135 dB, accuracy of + or - 1 dB; battery powered; design for measurement of sound output.

1.8.2 Megger Tester: Handheld; 500 V; three overlapping ranges, Insulation, Resistance, Continuity; 0-100 megohms; test voltage 500 VDC; with an accuracy of 1.5% of f.s. length.

1.8.3 Multi-Meter: Handheld multi-meter, (voltmeter) with a digital LCD display used to measure dc and ac voltages, dc and ac amps, ohms and perform diode tests, continuity tests, peak-hold, level detection of transitions that last 50 microseconds or longer, and conductance for making high resistance measurements.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.1.1 General: Materials, equipment and devices shall be tested and listed by Underwriters Laboratories, Inc., and Factory Mutual Research Corporation. The authorized representative of the manufacturer of the major equipment such as control panel, annunciator, transmitters, and initiating devices, shall install and be responsible for satisfactory total system operation and its certification. Manufacturer shall provide NICET certified personnel to test equipment.

2.1.2 Nameplates, Tags, Keys and Locks: Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a non-corrosive and non-heat sensitive, engraved plate which is securely attached to the equipment with screws or pop rivets. Tags with stamped identification number shall be furnished for keys and locks. All keys and locks shall be keyed alike.

2.1.3 Approved Manufacturers: Autocall, Edwards, Notifier, and Simplex.

2.2 CABLE AND WIRING: Electrical cable shall conform to UL 83 and the following.

2.2.1 All wiring shall be installed in metallic conduit, shall be color coded throughout and shall test free and clear of opens, grounds and shorts between conductors. All wiring shall be l6 gauge or minimum size as determined by the manufacturer, copper, with the exception of audio and visual alarm devices; Audio alarm speakers shall have 16 gauge shielded copper, and visual alarm devices shall have 12 gauge shielded copper. All wiring shall have a minimum insulation rating of 600 volts. All equipment shall be grounded with an approved earth ground wire being supplied at the control panel. All wiring shall be in conformance with Article 760 of the NFPA 70.

2.2.2 Furnish a proposed riser diagram for the fire detection and alarm system indicating all devices, equipment, and wiring with the submittals prior to construction. If changes are made during construction a corrected riser diagram shall be submitted with the operating and maintenance manuals upon project completion. Riser diagram shall use symbols as shown on the drawings and shall have room numbers adjacent to all devices. All wiring shall be in conduit.

2.2.3 Wires in junction boxes and cabinets shall be permanently tagged and identified with metal or phenolic tags attached by nylon ties.

2.3 CONDUIT AND FITTINGS: Conduit and fittings shall conform to UL 1, UL 6, UL 514B, and UL 797 as appropriate for the application, and be the type and size indicated or as necessary to match the items being replaced.

2.4 OUTLET BOXES AND FITTINGS: Boxes and fittings shall be galvanized steel or cast aluminum and conform to UL 514A and UL 514B and the following.

2.4.1 Paint boxes and covers red and identify with letters of white paint stenciled as "Fire Alarm System".

2.4.2 Junction boxes shall have a volume 40 percent greater than required by the NFPA 70. Minimum sized wire shall be considered as 14 gauge for calculation purposes.

2.4.3 Terminal cabinets shall have identified pressure type terminal strips, and shall be located at the base of each riser as shown on the drawings.

2.4.4 Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted.

2.5 ENCLOSURES: Enclosures shall be painted steel and conform to UL 50 and be the type and size indicated or as necessary to match the items being replaced.

2.6 SURFACE METAL RACEWAYS AND FITTINGS: Surface metal raceways and fittings shall conform to UL 5, and be the type and size indicated or as necessary to match the items being replaced.

2.7 AUDIO/VISUAL FIRE ALARM SIGNALING DEVICES: Interior fire alarm signaling devices shall be individual speaker and strobe type. Exterior fire alarm signaling devices shall be combination horn and strobe type. Each shall conform to UL 1971, and the following.

2.7.1 Unless otherwise indicated on the drawings, shall have a nominal rating of 87dB at ten feet.

2.7.2 Mount on removable adapter plates on conduit boxes.

2.7.3 Sprinkler system alarm indicating Audio/Visual signals located outdoors shall be horn and strobe, weatherproof type with weatherproof back-box, metal housing and protective grille.

2.7.4 Each signal circuit shall have a minimum of 20 percent spare capacity.

2.7.5 Devices shall have translucent white dome with 1/2 inch permanent red letters. Lettering to read "FIRE" and be visible from all viewing directions. Dome to be high impact non-yellowing plastic. Lamps shall be low voltage type for flashing service with a xenon flasher that meets ADA and UL 1971 requirements. Lamp circuits shall be supervised.

2.7.6 Install strobe only devices in public restroom applications.

2.7.7 When more than five strobes are in sight in any room, they shall be synchronized.

2.7.8 Strobe intensity shall be per the following table:

Minimum Required Light Output, Candela (cd)
(Effective Intensity)

Maximum Room Size in Feet	One Light Per Room (cd)	Two Lights per Room (Located On Opposite Walls) (cd)	Four Lights per Room One Light per Wall) (cd)
20 by 20	15	-	-
30 by 30	30	15	-
40 by 40	60	30	15
50 by 50	95	60	30
60 by 60	135	95	30
70 by 70	185	110	60
80 by 80	-	140	60
90 by 90	-	180	95
100 by 100	-	-	95*

*Rooms larger than 100 by 100 feet shall have 110 candela wall mounted strobes with 60 candela ceiling mounted strobes to supplement the wall mounted strobes. Space per manufacturer’s recommendations.

2.8 FIRE ALARM STATIONS: Fire alarm stations shall be addressable, manual, double action, non-coded, conform to UL 38, and the following.

2.8.1 Stations shall be connected to a remote interface monitor module as required, for addressable operation. Each module will have an engraved nameplate, acceptable to the COR, with the same name setup in programming.

2.8.2 To operate stations you must push the face panel and manually pull down which in turn activates the associated remote interface monitor module. The face panel locks in the down position providing a positive indication that the station has been operated. Stations can be reset to the normal position by the use of a special reset key.

2.8.3 Stations shall be constructed of a die cast metal or fire retardant polycarbonate, finished in red enamel with raised white lettering. Stations shall be jam-proof and shall be surface or semi-flush mountable. Stations shall offer a break rod feature which shall not be necessary for station operation.

2.9 SMOKE AND HEAT DETECTORS:

2.9.1 Ceiling-Mounted Smoke Detectors:

2.9.1.1 Ceiling mounted smoke detectors shall be addressable photoelectric type and conform to UL 217 and UL 268. Detectors shall be environmentally compensated, and calibrated and adjusted for sensitivity at the manufacturer's factory to UL 268 (Nominal 2.3 percent per foot smoke obscuration level). Detectors shall utilize solid state components and be equipped with a fully regulated LED light source for long life reliability and an insect screen to minimize nuisance alarms. Detectors shall provide a multiple pulse coincidence circuit to minimize false alarms from transient smoke conditions. When the alarm threshold value is exceeded for the first time, the detector shall go into alarm only after at least 2 more consecutive sample pulses have exceeded the alarm threshold values. Detectors shall be able to transmit obscuration information to FACP. Detectors shall have environmental compensation circuits and shall maintain constant sensitivity even when maintenance required messages are produced.

2.9.1.2 Either the detector head itself or the detector base shall use magnetic (switchless), binary dipswitches, or rotary decimal (hexadecimal) switches for the assignment of its individual address number when it is being field programmed. It shall also have a data communication line/alarm (flashing/steady) LED and terminals for making data communication line circuit connections. The detector/base assembly shall draw its power from the fire alarm control panel via the data communication line. The detector/base shall flash its LED, to assure communication, as it is being polled for status from the fire alarm control panel and shall report alarm or trouble status changes to it.

2.9.1.3 Outlet boxes for detectors shall be flush mounted. Each detector will have an engraved nameplate, acceptable to the engineer, with the same name setup in programming.

2.9.1.4 Smoke detectors shall not be located within 36 inches of any air diffuser or sprinkler head.

2.9.2 Duct Mounted Smoke Detectors:

2.9.2.1 Duct mounted smoke detectors shall be addressable photoelectric type and conform to UL 217 and UL 268A. Duct mounted detectors shall operate similar to ceiling smoke detectors and are to be equipped with suitable duct housings from the manufacturer. Sampling tubes are to be sized according to the actual duct they are placed across in the facility. Detector housings shall have a local test capability and status indicator LED, and provisions for connecting a remote status indicator LED. Detectors shall be able to transmit obscuration information to FACP.

2.9.2.2 Duct mounted smoke detectors shall be UL listed for their intended use and shall be compatible with the fire alarm equipment installed. Sampling tubes shall extend across the entire width of the duct and be secured properly on each end.

2.9.2.3 Each detector and duct housing shall be self-compensating for the effects of air velocity (from 500 to 3,000 feet per minute), temperature, humidity, and atmospheric pressure. It shall not be necessary to field adjust the sensitivity to compensate for the above effects.

2.9.2.4 Each detector shall be a 4-wire, 24 VDC type duct smoke detector utilizing solid state components and be equipped with at least 1 single-pole, single-throw (SPST) alarm relay with normally open contacts rated at 1 amperes, 115 VAC.

2.9.2.5 The 24 VDC power to the duct detectors and the number of duct detectors on each 24 VDC power loop is completely dependent on the alarm current of the duct detector and the fused capacity of the supervised power loop and these requirements shall be designated and shown on the fire alarm submittal.

2.9.2.6 There shall be a remote interface monitor allotted for each duct smoke detector in this facility. The normally open alarm relay contacts of the duct smoke detector will be terminated across the alarm initiating circuit of the monitor module to provide the duct smoke detector with device addressability when the detector goes into alarm. In addition, the normally closed trouble relay contacts will be terminated across the alarm initiating circuit of the monitor module to provide supervision of the 24 VDC power to the actual duct smoke detector.

2.9.2.7 These remote interface monitor modules shall be close-nippled to the duct detectors to facilitate wiring and interconnection. These duct detectors are shown on the fire alarm bid document drawings. Each module will have an engraved nameplate, acceptable to the Specifying engineer, with the same customer alphanumeric message setup in programming on this nameplate.

2.9.2.8 All duct mounted smoke detectors shall be installed in accordance with the standards and requirements set out in NFPA 90A, Installation of Air Conditioning and Ventilating Systems. The installing contractor will be responsible for installing any additional duct mounted smoke detectors that are needed to meet the latest requirements of NFPA 90A.

2.9.2.9 Duct smoke detectors associated with the same specific air handling unit shall be allotted to the same specific remote interface monitor module.

2.9.2.10 Provide a remote test station for each duct smoke detector. For duct smoke detectors in supply and return ducts of mechanical equipment, locate remote test stations at mechanical unit. For duct smoke detectors at fire/smoke dampers, locate remote test stations as close as possible to duct detectors locations. Mount test stations at 46 inches AFF.

2.9.3 Ceiling Mounted Heat Detectors:

2.9.3.1 Ceiling mounted heat detectors shall be addressable and conform to UL 521. Detectors shall be combination rate-of-rise and fixed temperature. Each detector shall utilize solid state components and the activation of the rate-of-rise or fixed temperature alarm functions shall be capable of being reset from the fire alarm control panel.

2.9.3.2 Either the detector head itself or the detector base shall use magnetic (switchless), binary dipswitches, or rotary decimal (hexadecimal) switches for the assignment of its individual address number when it is being field programmed. It shall also have a data communication line/alarm (flashing/steady) LED and terminals for making data communication line circuit connections. The detector/base assembly shall draw its power from the fire alarm control panel via the data communication line. The detector/base shall flash

its LED, to assure communication, as it is being polled for status from the fire alarm control panel and shall report alarm or trouble status changes to it.

2.9.3.2 Outlet boxes for detectors shall be flush mounted.

2.10 WATERFLOW SWITCHES: Waterflow switches shall be addressable, cane type waterflow detectors with adjustable retard feature and two sets of single-pole, double-throw (SPDT) alarm contacts to be supplied. Remote interface monitor modules will be installed to monitor each individual waterflow switch indicated on the drawings. These modules shall be flush or surface mounted to the wall at an appropriate location below the waterflow switch itself, so that maintenance personnel can readily view the supervisory LED on the module. They will be mounted at the same height as manual stations. Each module shall have an engraved nameplate, acceptable to the COR, with the same custom alpha-numeric message setup in programming on this nameplate.

2.11 VALVE SUPERVISORY SWITCHES: Valve supervisory switches shall be addressable, have die cast housings with integral tamper-proof switches designed to activate when the switch is removed. They will be monitoring outside screw and yoke type valves and have at least one set of single-pole, double-throw (SPDT) trouble contacts. Remote interface monitor modules will be installed to monitor each individual valve supervisory switch indicated on the drawings. These modules shall be flush or surface mounted to the wall at an appropriate location below the valve supervisory switch itself, so that maintenance personnel can readily view the supervisory LED on the module. They will be mounted at the same height as manual stations. Each module shall have an engraved nameplate, acceptable to the COR, with the same custom alphanumeric message setup in programming on this nameplate.

2.12 AIR HANDLING UNIT AND EXHAUST FAN SHUT DOWN RELAYS: Air handling unit and exhaust fan shut down relays shall be addressable, 24 VDC operation, mounted in surface cabinet. These relays shall be controlled and powered from the FACP. Contacts shall be 2-pole double-throw rated at 2 amps resistive 28 VDC/120 VAC.

2.13 FIRE ALARM CONTROL PANEL AND ANNUNCIATORS: Fire alarm control panel (FACP) and annunciators (FAAP) shall be four wire Class A and conform to UL 864.

2.13.1 Function:

2.13.1.1 Operate as a supervised, positive noninterfering successive alarm system. Each power source shall also be supervised from the other source for loss of power.

2.13.1.2 Supervise all signal initiating circuits, alarm indicating circuits, alarm transmitter trip circuits, and sprinkler and standpipe valves.

2.13.1.3 Detect the operation of any signal initiating device and the area of the alarm condition, and operate all alarm and designated auxiliary devices.

2.13.1.4 Visually and audible annunciate any trouble condition such as main power failure, ground or system wiring derangement, and sprinkler system and standpipe valve off-normal position.

2.13.2 Central Processing Unit (CPU):

2.13.2.1 The CPU shall utilize either an 8 bit or 16 bit microcontroller with the necessary system logic circuitry and interrogate/response polling to per-

form all required automatic control-by-event functions and trouble switching as established by this specification.

2.13.2.2 The CPU shall supervise the entire system's operation for alarm, trouble, power normal and data communications. Assigned custom alphanumeric messages shall be displayed for all alarm and trouble conditions, supervision of the addressable monitor or control devices shall be on a per address basis and shall not reduce the available system address.

2.13.2.3 The CPU must incorporate circuitry to continuously monitor the communications and data processing of the microprocessor for positive and negative ground faults, data line polling, and primary and secondary power loss. Occurrence of any such faults shall sound and audible signal at the CPU to advise attending personnel.

2.13.2.4 The CPU shall be equipped with a system operating panel that shall contain at least a 32-character liquid crystal (LCD) display and system status LEDs to provide immediate indication of any abnormal condition. Custom alphanumeric messages, setup in programming, shall accompany any status LED indication to precisely locate any abnormal event. During normal system operation, a green LED indicates "NORMAL", a yellow LED indicates "TROUBLE", and a red LED indicates "ALARM".

2.13.2.5 The CPU shall provide two way communication with a minimum of 192 addressable field initiating and/or control devices, capable of being T-tapped for a 3-conductor #18 AWG shielded wire. The system shall allow a minimum 2,500 foot wiring length to the furthest addressable device. To minimize wire routing and to facilitate future additions, T-tapping of the data communications channel shall be supported on a Class A wiring basis. Each addressable circuit from the CPU shall be sized to allow 20 percent spare capacity for the future addition of addressable devices without additional wiring from the CPU.

2.13.2.6 The total capacity of the system shall be a minimum of 3,000 addressable field initiating and/or control devices. Each FACP CPU shall be capable of operation multiple system printers.

2.13.2.7 The data communication format shall be poll/response protocol to allow T-tapping of the wire to addressable devices and shall be digital or voltage pulse width modulated. Systems that do not utilize either of these two transmission protocols will not be acceptable.

2.13.2.8 Each addressable field initiating and/or control device shall be uniquely identified by an address code using magnetic (switchless), binary dipswitches, or rotary decimal (hexadecimal) switches for the assignment of its individual address number when it is being field programmed.

2.13.2.9 The FACP CPU shall be provided in a surface mounted cabinet made of at least 16 gauge steel with welded construction. The system operating panel shall be located behind a locked door assembly with keys made available only to authorized personnel. All LED indicators and switches shall be labeled and the fire alarm control panel shall be provided with a set of permanently mounted operating instructions on the front of the panel itself.

2.13.2.10 The FACP shall provide one way audio voice alarm and tone generating capabilities.

2.13.2.10.1 A central audio control module shall be provided for the necessary alarm message/tone generation, main microphone connections and mixer/pre-amplifier circuits. Continuous supervision shall be provided along with specific information as to the type of failure should a problem occur,

(eg. main microphone trouble, tone trouble, etc.). Audio outputs shall have individual gain control.

2.13.2.10.2 A hand-held, push-to-talk microphone shall be provided, recessed within a protective panel-mounted enclosure in the (FACP). The microphone shall be a noise-canceling communication type with a frequency range of 200 Hz to 4000 Hz and shall be equipped with a self-winding five-foot coiled cable. An LED indicator shall be provided to indicate the microphone push-to-talk button has been pressed and speaker circuits are ready for transmission. The microphone shall be supervised for disconnection.

2.13.2.10.3 An audio control switch module shall be furnished to provide manual access to audio operations for authorized personnel. The module shall include an "ALL Circuits" switch, "Aux Tone 1" switch, "Aux Tone 2" switch, tone generator stop switch, and "Audio Trouble Reset" switch. These switches and associated LED indicators shall be supervised for disarrangement or failure.

2.13.2.10.4 Audio power amplifiers shall be furnished with a self-contained filtered 24VDC power supply, transformer, and amplifier monitor circuits. The amplifiers shall provide a 25 Volt RMS, 90 Watt output, in a Power Limited configuration, with a frequency response of 120 Hz to 12,000 Hz. Provide sufficient amplification to operate all system speakers simultaneously plus ten (10) percent spare capacity.

2.13.2.10.5 The speaker circuits shall be capable of supplying 25 Volt RMS audio power from the system amplifiers. Supervision for open, short or ground fault conditions shall be provided. Individual and distinct trouble indications shall be provided for each fault. Provide one circuit for each floor.

2.13.2.10.6 Digitized tones for alarm (slow whoop) and auxiliary requirements (wail, horn, chime, etc.) shall be provided.

2.13.2.10.7 A pre-recorded digitized voice message capability is to be provided for automatic transmission to building occupants during alarm conditions. The automatic message player shall not rely on a tape or other mechanical means of transmitting the evacuation message.

2.13.2.10.8 Two custom messages shall be provided under this contract, one indicating FIRE emergency evacuation, and one indicating Weather Emergency take cover.

2.13.2.10.9 The message player shall be capable of transmitting these custom messages of a minimum of five (5) minutes long. A self-contained speaker shall provide testing of the message(s) without disturbing the occupants of the facility. These pre-recorded digitized P.N.I.S. (Positive Non- Interfering Successive) "voice coding" capability shall be provided for automatic transmission to building occupants during alarm conditions. A separate "voice code" shall sound throughout the facility for Fire alarm, and Weather alert conditions. Provide a Chip, which shall include Fire Alarm Evacuation, All Clear, Drill messages, Weather Alert, All Clear and Drill messages. Preliminary examples of "voice code" messages are as follows:

2.13.2.10.9.1 An emergency has been reported, please walk to the nearest exit and leave the building.

2.13.2.10.9.2 A weather emergency has been reported, please walk to your designated shelter area.

2.13.2.10.10 The owner shall provide final approval of the exact voice messages prior to ordering, installing, or programming these chip sets.

2.13.2.10.11 The automatic voice evacuation sequence alarm signal shall consist of an alarm tone for a maximum of 15 seconds followed by automatic pre-selected voice evacuation messages. At the end of each voice evacuation message, the alarm tone shall resume. The alarm tones/message shall sound alternately until the alarm silence switch at the (FACP) has been operated. All audio alarm operations (speaker circuit selection and alarm tone/voice message timing variations) shall be activated by the system software so that any required future changes to the evacuation sequence can be facilitated by authorized personnel without any component rewiring.

2.13.2.10.12 The system shall be configured to allow selective manual voice paging. Upon activation of any speaker circuit manual control switch, two (2) attention signaling beeps shall sound over the speakers indicating an impending voice message will occur. When a speaker circuit manual control switches are activated, the control panel operator shall be able to make announcements via the push-to-talk paging microphone over the selected speaker circuits. Total building evacuation and paging shall be provided to allow for activation of all speakers. This shall be accomplished by the means of an "All Circuit" switch.

2.13.3 Software:

2.13.3.1 The CPU shall utilize non-volatile EPROM or EEPROM solid-state memory for the main core system configuration data base and system program instructions only.

2.13.3.2 However, the CPU shall be completely field programmable on site by the manufacturer's representative by the use of a portable configurator programmer device or thru the use of an operator interface keypad. Edited changes must be nonvolatile. All program access shall be passcode protected.

2.13.3.3 Systems requiring factory EPROM burn-in or on-site field EPROM burn-in by the manufacturer or manufacturer's representative to retain the initial programming or later field changes for all the custom alphanumeric messages for all the field initiating or control devices shall not be acceptable.

2.13.3.4 Custom alphanumeric messages for field devices shall be retained in non-volatile EEPROM solid-state memory or in RAM memory with lithium battery backup. All addressable devices shall also be completely field programmable for device address assignments.

2.13.3.5 The CPU shall be software equipped to provide automatic control-by-event programming, whereby the receipt of an alarm condition from an addressable fire alarm device or alarm initiating remote interface monitor module may be programmed to operate an addressable fire alarm control relay or remote interface control module within the system. Automatic control-by-event actions for life safety functions shall be retained in non-volatile EEPROM solid-state memory or in RAM memory with lithium battery backup for system reliability.

2.13.4 Enclosure:

2.13.4.1 The FACP shall be housed in a cabinet suitable for flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

2.13.4.2 Cabinet shall contain all necessary relays, terminals, lamps, and legend plates to provide control for the system.

2.13.5 Power Supply:

2.13.5.1 The FACP shall derive its normal power from a 120 VAC, 60 Hz supply. Standby power shall be provided by a 24 VDC battery as hereinafter specified. The normal power shall be transformed, rectified, coordinated, and interfaced with the standby battery and charger.

2.13.5.2 The door holder power shall be arranged so that momentary or sustained loss of main operating power shall not cause the release of any door for a minimum of five minutes. This may be accomplished by floating the door holders across the battery supply or by other approved means accomplishing the same function.

2.13.5.3 Power supply for smoke detectors shall be taken from the FACP.

2.13.5.4 Provide protectors to protect the fire alarm equipment from damage due to lightning or voltage and current transients.

2.13.6. Circuit Arrangement:

2.13.6.1 Provide means whereby any zone or signal circuit may be disconnected from the system. Removing any zone or alarm circuit shall leave the remainder of the system in normal operating condition, and light an individual trouble lamp which shall remain lighted until the circuit is restored to normal operating condition.

2.13.6.2 Arrange circuits so that if an open circuit occurs in the signal coil, it shall not prevent other audible signals on the same circuit from sounding.

2.13.6.3 Each circuit shall be individually fused.

2.13.7 Circuit Supervision:

2.13.7.1 Each alarm initiating circuit, alarm indicating circuit, and local energy transmitter trip circuit, and sprinkler and standpipe valve circuit shall be supervised against the occurrence of a break or ground fault condition in the field wiring. These conditions shall cause a trouble signal to sound in the control panel until manually silenced by an off switch.

2.13.7.2 Sprinkler system valves, standpipe control valves, PIV, and main gate valves shall also be supervised for off-normal position. Valve supervision shall indicate where the valve is located. Closing a valve shall sound a supervisory signal in the control panel until silenced by an off switch. Valve operation shall not cause an alarm signal.

2.13.7.3 Each circuit shall have individual trouble lamps (amber) and alarm lamps (red).

2.13.8 Trouble Signals:

2.13.8.1 Arrange the trouble circuit for ring back operation to prevent switch disarrangement during normal supervisory condition. Automatic reset arrangement is acceptable in lieu of ring back operation.

2.13.8.2 System trouble switch off and on lamps shall be visible through the control panel door.

2.13.9 Modules:

2.13.9.1 Module assemblies shall be of unit type construction and mounted on channels to permit easy removal and service by circuit function.

2.13.9.2 Modules shall contain system fault locators to enable maintenance personnel to pinpoint individual fault conditions on the following:

2.13.9.2.1 Each individual initiating circuit.

2.13.9.2.2 Each individual unset condition of alarm and trouble transmitters.

2.13.9.2.3 AC power supply.

2.13.9.2.4 DC standby power supply.

2.13.9.2.5 Smoke detector supply circuit breaker.

2.13.9.3 Each module shall contain alarm indicators to indicate which zone is in alarm.

2.13.9.4 Modules shall have provisions for relaying incoming zone alarms to light lamps on a remote annunciator and perform auxiliary functions. Modules shall discriminate an incoming zone alarm as to category (manual alarm; smoke alarm; waterflow alarm) and indicate the signal at the remote annunciator as to zone and category.

2.13.9.5 Each initiative alarm circuit shall have its own control module. Modules shall not serve mixed device categories.

2.13.10 Printed Circuit Boards: Shall be of easily removable type and have sufficient capacity for the circuits controlled.

2.13.11 Auxiliary Control Capability: FACP shall perform auxiliary control functions on a common or selective basis as required.

2.13.12 Function Switches: Provide the following switches in addition to any other switches required for the system.

2.13.12.1 Master Building Transmitter Switch: Shall prevent tripping of alarm transmitter when in off position. System trouble alarm shall be energized when switch is in off position.

2.13.12.2 Alarm Off Switch: Shall disconnect power to alarm indicating device circuits. System trouble alarm shall be energized when switch is in off position.

2.13.12.3 Trouble Off Switch: Shall silence the trouble signal whenever the system trouble circuit is energized.

2.13.12.4 Reset Switch: Shall reset the system after an alarm, provided the initiating device has been reset. The system shall lock in until reset.

2.13.12.5 Test Switches: A test switch or other approved convenient means shall be provided to test the indicator lamps.

2.13.12.6 Drill Switch: Shall sound the alarm indicating devices without tripping the alarm transmitter.

2.13.12.7 Master Door Release Switch: Shall prevent doors from releasing during fire alarm tests. A visual indicator shall show the off-normal condition.

2.13.13 System Expansion: Design the control panel so that the system can be expanded in the future (to include the addition of twenty percent more circuits or zones) without disruption or replacement of the existing control panel.

2.14 BATTERY AND CHARGER:

2.14.1 Battery:

2.14.1.1 Shall be 24 VDC nominal.

2.14.1.2 Battery shall have sufficient capacity to power the fire alarm system for not less than forty-eight hours plus fifteen minutes of alarm to an end voltage of 12 volts per cell, upon normal AC power failure. System load shall include the power required by the electromagnetic door holders for a minimum of five minutes.

2.14.1.3 Batteries shall be mounted within the fire alarm control panel.

2.14.2 Battery Charger:

2.14.2.1 Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120 VAC, 60 hertz source.

2.14.2.2 Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.

2.14.2.3 A trouble condition shall actuate the fire alarm trouble signal.

2.14.2.4 Charger shall have automatic AC line voltage regulation, automatic current-limiting features, and adjustable voltage controls.

2.15 CHARTS AND LOCATIONS:

2.15.1 Charts: Print with easily readable, uppercase type, minimum 3/16 inch size letters.

2.15.2 Chart Locations: Laminate or mount under Plexiglas in a neat frame, and install adjacent to the FACP. Six additional unframed charts shall be delivered to the COR.

2.16 REMOTE RADIO TRANSCEIVER SYSTEM: Refer to SECTION 16722, REMOTE RADIO TRANSCEIVER SYSTEM.

PART 3 EXECUTION

3.1 GENERAL: Install an addressable fire detection and alarm system (FDAS) as indicated on the plans and specified herein.

3.2 INSTALLATION: Install the FDAS in accordance with NFPA 70 and NFPA 72, the manufacturer's written installation instructions, the contractor's ap-

proved shop drawings, and the requirements herein. All FDAS devices shall be flush mounted unless otherwise indicated.

3.2.1 Fire Alarm Signaling Devices: Mount fire alarm signaling devices a minimum of 96 inches above finished floor unless limited by ceiling height.

3.2.2 Fire Alarm Stations: Mount fire alarm stations 48 inches from top of pull station to finished floor.

3.2.3 Smoke and Heat Detectors: Mount ceiling mounted smoke and heat detectors no closer than 36 inches to any diffusers of air handling systems and 12 inches from any lighting fixture.

3.2.4 Duct Smoke Detectors: Provide duct detectors in both the supply and return air ducts for air handling units, fan coil units make-up air unit, and exhaust fans 2,000 CFM or larger. Provide fan shut down relays to shut down AHU's make-up air units, relief fans, exhaust fans and fan coil units over 2,000 CFM.

3.2.5 Fire Alarm Control Panels and Annunciator Panels: Mount FACP and annunciator panels between 48 to 78 inches from top of control panel to finished floor.

3.2.6 Grounding and Bonding: Ground and bond FDAS devices and equipment in accordance with NFPA 70 and UL 467.

3.3 OPERATION: The FDAS shall automatically initiate fire detection and alarm signals whenever any manual, automatic fire detecting devices are placed into an alarm mode. The FDAS shall indicate individual devices in alarm on the control panel and the annunciator panel, as indicated on shop drawings and described here with-in, and at the same time, deactivating the supplying and/or exhaust units, all deactivated units will restart when FACP is returned to normal or the controller's by-pass switches is turned to the by-pass position. The control for the supplying and/or exhaust units shall operate together but the trouble indication shall report independently by floor levels to the fire control panel and the annunciator panel. When in by-pass mode a trouble signal will show on the main control panel and annunciator panel. The building radio transceiver will transmit the alarm and/or trouble zone signal to the central fire station. The FDAS will sound an alarm audio tone, followed by a voice evacuation message automatically through the speakers within the building and indicate visually through the alarm indicating strobes. On a sprinkler system alarm condition, the exterior horn/strobe alarm indicating device shall also indicate, both audio and visually, that the sprinkler system is in an alarm condition. In trouble mode will only sound the trouble horns located in the FACP and annunciator panel. The FACP supplier shall supply a silence push-button at each location to silence the trouble horn. Alarm signal shall be consistent throughout the building or site upon the operation of any alarm initiating device except the individual smoke detectors located in sleeping areas. **Note**: Room heat detectors shall operate independently from room smoke detectors and will alarm the building alarm system, the smoke portion of the detector shall sound only as a local alarm in the individual rooms). Station loops and signal circuits shall be electrically supervised so that all devices will function with a single open or ground fault. The fire alarm signaling devices shall sound in march time.

3.4 WIRING: The FDAS operation shall be four wire Class A (Style D) alarm indicating appliance circuits and four wire Class A (style 7) signaling line circuits (SLC) for addressable circuits. The Contractor and his manufacturer's representative shall be required to calculate voltage drop and properly size system wiring. They shall size the electrical conduit for the num-

ber of wires required to operate all fire detection and alarm equipment using NFPA 70 Codes and contract requirements. The minimum size shall be 16 gauge solid copper wire. Strobe circuits shall be a minimum 14 gauge shielded. SLC circuits shall utilize manufacturer approved cable. The installation of wiring and equipment shall be in accordance with NFPA 70, Article 760. The system wiring shall not affect the operation of any other indicating circuit if an open, ground, or short circuit fault in one alarm indicating circuit occurs. All termination's and splices shall be uniquely and permanently marked in accordance to submitted number system.

3.4.1 Power and Control Wiring: Install shielded wiring to all strobe lighting circuits. Power wiring and control wiring shall be isolated. All conductors shall be color coded and uniquely labeled. Two different color codes shall be used for each alarm circuit; one for each loop. Wiring code color shall remain uniform throughout the circuit. "Pigtail" or "T-tap" connections to alarm initiating and alarm indicating circuits are unacceptable.

3.4.2 Alarm Zones: All initiating devices shall be addressable indicating exact locations. Addressable devices shall be subgrouped by zone as follows only for the purpose of reporting to the Monaco System. FACP/FAAP shall indicate each addressable device location. Alarm zones shall be divided by floor levels. Devices shall be divided into different alarm zones by device types, for example, "pull stations", "smoke detectors" and "sprinkler system". Horn/strobe signaling devices shall be divided by floor level. Signaling horn/strobe units shall be connected to different power supplies to prevent a total system failure. The sleeping areas room heat detectors shall be on different zones and have one zone circuit for each floor level. The hallways, equipment rooms, boiler room, crawl spaces, mechanical and electrical rooms and fire sprinkler rooms shall have a dedicated zone for each area. The hallway smoke detector zones shall be divided into a one zone per floor. Each hallway zone shall not to exceed 200 feet in length. Two or more zones for combined hallways over 400 feet in length, but must be interconnected. Each fire alarm zone shall report to the Monaco transceiver. Trouble alarm zone signals shall be combined into one signal. Fire alarm zones and trouble alarm zone shall be transmitted to the Fort Riley Main Fire Station.

3.4.3 Wiring: No more than one conductor shall be installed under any screw terminal. All circuit conductors entering or leaving any mounting, outlet box enclosure or cabinet shall be connected to terminals or NFPA or UL approved 4 wire style D quick-disconnect wiring harness.

3.4.4 Removal of Old Equipment: Remove all old wiring, conduit, junction boxes and associated fire detection and alarm equipment. Repair and paint to match surrounding areas were old equipment was removed.

3.4.5 Two Loop Electrical Conduit System: Install fire alarm in a two loop electrical conduit system, a two-loop system shall be provided so that if any one conduit and all conductors contained in that conduit are severed all "Initiating Device Circuits" (IDC), "Indicating Appliance Circuits" (IAC) or "Signal Line Circuits" (SCL) on that circuit shall remain functional.

3.5 CONDUIT AND/OR WIRE RACEWAY AND JUNCTION BOXES: Wiring for the system shall be installed in minimum 3/4 inch EMT conduit or metallic Wiremold. Metallic Wiremold may only be used where specified on the drawings. NOTE: Variance to 3/4 inch EMT conduit; When pull stations and/or horn/strobe conduit drops are being installed, the Contractor shall install 1/2 inch EMT conduit or metallic Wiremold to in-line junction boxes.

3.5.1 Conduit and Raceway: All metal conduit located above any removable type ceiling and all concealed areas shall not require paint. All Wiremold

type wire raceway shall have an ivory color before being painted to match installed areas.

3.5.2 Conduit and Raceway: All conduit raceways shall be concealed within the wall cavity. All other conduit raceway located above drop ceilings, below floors, in crawl spaces and mechanical rooms shall be installed unpainted and surface mounted. Any variance to the installation of conduit raceways or fire alarm devices shall require prior approval by the Contracting Officer, with recommendation from the design engineer. For approved variances; all surface mounted conduit and wire raceway not installed above drop ceilings, below floors, in crawl spaces and mechanical rooms shall be primed and painted to match surrounding areas; all exposed electrical conduit and wire type raceway shall be installed in vertical/horizontal lines; conduit and wire raceway shall be installed in the corners of walls, along ceilings or at the floor baseboards.

3.5.3 Ceiling Tile, Grids and Junction Box Supports: Install new tiles, ceiling grids and box support brackets for all new detectors being install in this contract.

3.6 REPAIR DAMAGED AREAS: Patch, prime and paint all damaged areas where old systems were removed in this contract. Replace ceiling tiles and grid where old fire alarm systems were removed.

3.7 ELECTRICAL DISCONNECTS: Install electrical disconnects, dedicated to fire alarms and radio transceivers. The circuit breaker panel feeders to the electrical power source shall be 6 gauge copper wire. The branch circuit shall be connected to each system from the fire alarm panelboard. Minimum circuit size shall be 15 amp 120 volt. Each circuit shall be install in electric metallic conduit system. The minimum wire size shall be 12 gauge copper wire. The minimum circuit breaker panel main buss shall be 70 amp and the type of enclosure shall be rain tight. The FA circuit breaker panel (FACBP) shall be sized for full size circuit breakers only. The FACBP raintight panelboard shall be secured to preventing inadvertent switching off the circuit breaker to the fire alarm, radio transceiver or sprinkler air compressor system. Circuit breakers shall have UL listed interrupting rating of greater than 22,000 RMS symmetrical amperes. Panel directories shall be provided and indicate new circuits. The fire alarm/radio transceiver/air compressor panel shall be "red" in color. If the fire sprinkler air compressor system is located in a different room, (not in line-of-site), the Contractor shall install a non-fused service disconnect next to the air compressor.

3.8 JUNCTION BOXES AND SUPPORTS: All junction boxes and supports shall meet NEC requirements.

3.8.1 Install approved metal supports on all fire alarm junction boxes, for the detectors, that are being installed on acoustical ceiling. All junction boxes installed on acoustical ceiling shall be supported by a factory bar clamp designed for that type application and be feed with flexible metallic conduit.

3.8.2 All junction boxes installed above acoustical ceiling and installed in electrical, mechanical, or boiler rooms, shall have "red" covers installed.

3.8.3 All junction boxes installed in the fire alarm system, if approved for surface mounting in exposed areas, the junction boxes and mounting boxes shall be supplied with the factory fire alarm device and the Contractor shall not be allowed to install a standard KO type junction box.

3.8.4 All junction boxes not installed above drop ceilings, below floors, in crawl spaces and mechanical rooms shall be a factory finished box. Standard KO junction boxes will not be allowed.

3.9 POWER SUPPLY: Power supply for the alarm systems shall be a single dedicated branch circuit with surge protection for each building system.

3.10 TESTING AND SPECIFICATIONS: Notify the Contracting Officer 10 calendar days before the performance and acceptance tests are to be conducted. The tests shall be performed in the presence of the COR, PW FPPD, PW OMD FDAS technicians, and the FDAS components manufacturer's factory representative. The Contractor shall furnish all instruments and qualified personnel required for the tests. Any tests rescheduled due to Contractor's deficiencies causing the testing to be suspended or delayed, the Contractor shall be charged $300.00 for each delay.

3.10.1 Performance Tests: Upon completion of the installation, the system shall be subjected to complete functional and operational performance tests including tests of each installed heat and smoke detector by the Contractor. Megger tests shall be conducted to include testing of all system conductors to determine that the system is free from grounded or open circuits. The megger tests shall be conducted prior to the installation of fire alarm equipment. Smoke detector bases shall be equipped with jumpers for the megger test. When all corrections are made, the system shall be re-tested to assure that it is functional.

3.10.2 Acceptance Test For Fire Alarm Control Panels: Submit proposed test procedures for approval at least 14 calendar days prior to commencement of acceptance testing. The test shall be reconducted to verify correction of any defect found in the initial testing. The testing shall be in accordance with NFPA 72. The Contractor shall furnish the "Fire Alarm System Certification and Description" from NFPA 72. The manufacturer's representative shall be required to sign the "Certification of System Operation and Testing" and the Contractor shall sign the "Certification of System Installation", in addition the following test shall be completed.

3.10.2.1 Test of each function of the control panel.

3.10.2.2 Test of each circuit in both trouble and normal modes.

3.10.2.3 Tests of alarm initiating devices in both normal and trouble conditions.

3.10.2.4 Tests of each control circuit and device.

3.10.2.5 Tests of each alarm indicating device.

3.10.2.6 Tests of the battery charger and batteries.

3.10.2.7 Complete operational tests under emergency power supply.

3.10.2.8 Visual inspection of all wiring.

3.10.2.9 Opening the circuit at each alarm initiating and indicating device to test the wiring supervisory feature.

3.10.2.10 Testing the FM radio transceivers with the fire alarm system from the Fire Station Central fire alarm system:

3.10.2.11 Test the electromagnetic door holder to release when activated by the fire alarm panel.

3.11 ACCEPTANCE OF TESTING: Criteria for testing shall be as follows:

3.11.1 Horns: Horns shall deliver the sound pressure levels (decibels) of the specified device.

3.11.2 Visual Units: Visual units shall be illuminated on alarm and remain illuminated until system is reset.

3.11.3 Stations: Stations shall close the circuits specified.

3.11.4 Automatic Detectors: Automatic detectors shall actuate the system when the appropriate fire and smoke conditions are generated.

3.11.5 Panels and Supervisory Devices: Panels and supervisory devices shall display and control functions as specified.

3.11.6 Air Handler Duct Detector: The air handler in-duct detector shall de-energizer the air handler fans when the fire alarm system is in alarm mode. During alarm activation a signal from the air handling fire alarm control panel shall sent an alarm to the FACP and activate the building fire alarm system. The FACP and annunciator control panels will indicate an air handler # fire alarm.

3.11.7 Fan Shutdown Control Relay: The fan shutdown control relays (FCR), shall de-energizer the supply or exhaust fans when the fire alarm system is in alarm mode, except when in by-pass. The control panels will have a trouble indication when the switch is in the by-pass mode.

3.11.8 Electromagnetic Door Holder: Electromagnetic door holder shall be tested with a pulling meter the test the holding power meets the a minimum of 35 pounds.

3.11.9 Sprinkler Flow and Tamper Switches: Sprinkler flow and tamper switches shall be tested for proper operation.

3.11.10 Sprinkler Low Air Pressure Switches: Sprinkler low air pressure switches shall be tested for proper operation.

3.12 RETESTING: Reconduct tests to verify corrections of any defects found in the initial testing.

DIVISION 16 - ELECTRICAL

SECTION 16722

REMOTE RADIO TRANSCEIVER SYSTEM

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for the installation of remote radio transceiver system as required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 Electronic Industries Alliance (EIA-TIA) Standard:

204-D	Minimum Standards for Land Mobile Communication FM or PM Receivers, 25 - 866 MHz.

1.2.2 Federal Standard (FStd):

595	Colors.

1.2.3 National Fire Protection Association (NFPA) Standards:

70	National Electrical Code (NEC).
72	National Fire Alarm Code.
1221	Installation, Maintenance and Use Of Public Fire Service Communications.

1.2.4 Underwriters Laboratories (UL) Publications:

1	Flexible Metal Conduit.
5	Surface Metal Raceways and Fittings.
6	Rigid Metal Conduit.
50	Enclosures for Electrical Equipment.
83	Thermoplastic-Insulated Wires and Cables.
467	Grounding and Bonding Equipment.
514A	Metallic Outlet Boxes.
514B	Fittings for Conduit and Outlet Boxes.
632	Electrically Actuated Transmitters.
797	Electrical Metallic Tubing.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation, Operation, and Maintenance Instructions: Submit manufacturer's written installation, operation, and maintenance instructions.

1.3.3 Shop Drawings: Submit shop drawings showing the proposed installation of the remote radio transceiver system. Shop drawings shall include system wiring schematic and a complete list of equipment and materials, including manufacturer’s description and technical literature, catalog cuts, and installation instructions.

1.3.4 Qualifications: Submit evidence of work experience, training, and certification for the company and employees that will be performing the work in this contract in accordance with paragraph 1.4, QUALIFICATIONS.

1.3.5 Spare Parts: Submit a list of the manufacturer's recommended spare parts for the system.

1.3.6 List of Zones: Submit a list of zones.

1.3.7 Test Reports: Submit test reports for the tests required in paragraphs 3.9 and 3.10.

1.3.8 As-Built Drawings: Submit as-built drawings for all work performed under this section. Provide additional copy to Ft. Riley DOIM.

1.4 QUALIFICATIONS:

1.4.1 "Radio Transceiver Contractor" shall have a minimum of 2 years experience in the installation and maintenance of radio transceivers and electronic fire alarm systems.

1.4.2 "Radio Transceiver Installers" shall have a minimum of 5 years experience in the installation, troubleshooting, field repair, and maintenance of all types radio fire alarm transceivers, in addition, the installer shall be factory trained on the radio alarm system prior to the installation being performed.

1.4.3 "Quality Control Manager" shall have a minimum of 5 years experience in the installation, troubleshooting, field repair, and maintenance of all types of electronic fire alarm systems, and shall hold a certification as an Engineering Technician (ET) by National Institute for Certification in Engineering Technologies (NICET) or Electrical Engineer (EE). Evidence of such training shall be submitted to the Contracting Officer 5 working days prior to start of work.

1.5 TRAINING FOR GOVERNMENT PERSONNEL:

1.5.1 Training Course: Furnish a factory certified and qualified instructor to conduct a training courses for operating staff and/or fire alarm equipment service contractor personnel performing work at the Fort Riley Fire Station Building 5000 or as designated by the Contracting Officer. The class room and field training will be on the new Contractor installed system(s). The training period shall consist of a minimum of 2 training days 4 hours per day for Operation Training, and minimum of 2 training days 4 hours per day for Preventative Maintenance and Troubleshooting and Repair procedures. The training shall start after all the systems are functionally completed but prior to the final acceptance test. The class room and field instructions shall cover op-

eration, preventative maintenance, troubleshooting and repair procedures contained in the Manufacturer's Operating and Maintenance Instructions. All training shall be scheduled with a minimum of 10 days notice provided to the Government prior to the start of training. All training shall be coordinated with the Contracting Officer prior to finalizing the training schedule.

1.5.2 Operating and Maintenance Instructions: Furnish a sufficient quantity of final approved copies of the complete Operating and Maintenance Instructions, 14 calendar days prior to training. The instructions shall outline operating and maintenance procedures, and contain troubleshooting guide, and shall be submitted and approved prior to the training course. The Operating and Maintenance Instruction manuals shall be used for class and field training.

1.5.3 Training Equipment: Furnish all fire alarm radio training equipment required to conduct the training course. The class room instruction shall cover operation, preventative maintenance, troubleshooting and technical repair procedures.

1.6 SPARE PARTS: Submit a list of the manufacturer's recommended spare parts for all systems. Furnish a minimum of 2 percent of all fire alarm devices installed to include the manufacturer's recommended spare parts, at the completion of the contract. Three complete sets of all special equipment needed to remove, inspect and/or repair the system shall be supplied to the Government at no additional cost. Use Government form DD 1348-1 for turn in all spare parts. Turn-in all spare parts and special equipment to PW OMD, with the COR present. All spare parts and equipment being turned over to the Government shall be cataloged by nomenclature, part number, quantity and cost. The DD 1348-1 shall be signed by the Contractor and Government Personnel receiving the material.

1.7 WARRANTY SERVICE MAINTENANCE: Maintain the fire alarm system for two years from the date of acceptance by the Government. Be on site to repair the fire alarm system within 8 hours after receiving a call from the Contracting Officer, or as further delegated.

1.8 TEST EQUIPMENT: Suggest the Contractor use the following test equipment to perform the required tests in this section.

1.8.1 Field Strength Meter with Case: Meter is for measuring antenna field strength. It is portable and battery operated with provision for an ac adapter/charger. The meter reads directly in dBm and microvolts. The meter requires for industrial alkaline 9-volt Eveready Energizer batteries PN EN22 or Equal, to be supplied with meter.

1.8.2 Frequency Counter with Case: The frequency counter will measure frequencies in the 50 MHz to 520 MHz range with a 50 ohm channel. It will make time interval or signal period measurements. Resolution is provided from 0.1 Hz to 10 kHz in decode steps. Features may be individually selected or measurement functions may be automatically selected and the counter will choose the correct range for best resolution, position the decimal point properly and light an LED identifying the unit of measurement.

1.8.3 Megger Tester: Handheld; 500V; three overlapping ranges, Insulation, Resistance, Continuity; 0-100 megohms; test voltage 500 VDC; with an accuracy of 1.5% of f.s. length.

1.8.4 Multi-Meter with Case: Handheld multi-meter, (voltmeter) with a digital LCD display used to measure dc and ac voltages, dc and ac amps, ohms and perform diode tests, continuity tests, peak-hold, level detection of transi-

tions that last 50 microseconds or longer, and conductance for making high resistance measurements.

1.8.5 Programmable Scanner with Case and Power Supply: The scanner will cover all major frequency ranges, including military land mobile, 2 meter amateur and high band. It is crystal-free and provides 16 channels and search, hold and automatic lockout functions. Manual, direct channel access is required. The scanner will operate on rechargeable batteries and include ac adapter/battery charger. Two sets of rechargeable batteries will be supplied with Programmable Scanner (12 each AA nickel-cadmium batteries), flexible antenna, earphone.

1.8.6 RF Wattmeter Kit with Resistor Case: Portable directional wattmeter for measuring both forward and reflected RF power levels in 50 ohm coaxial cable transmission system. This meter may be connected in the coax line, (thru line) between the transmitter and antenna. Antenna or load VSWR is easily determined from power readings by using of a chart the pack panel. Neither ac or battery power is required.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and be the most current design which conforms to the requirements specified.

2.1.1 General: The equipment specified in this section is Monaco Enterprises Inc., BT-2 Remote Alarm Transceiver System. The remote radio alarm transceiver system is to be compatible with the existing Monaco Enterprises D-500 Plus Central Control Systems, antennas, aerial lines, underground lines, interior runs of conduit and wiring, interface panels, circuit breakers and panelboards, etc., necessary for proper operation of the system as required in this project.

2.1.2 Nameplates, Tags, Keys and Locks: Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a non-corrosive and non-heat sensitive plate, engraved plate which is securely attached to the equipment with screws or pop rivets. Tags with stamped identification number shall be furnished for keys and locks. All keys and locks shall be keyed alike.

2.2 CABLE AND WIRING: Electrical cable shall conform to UL 83 and the following.

2.2.1 All wiring shall be installed in metallic conduit, shall be color coded throughout and shall test free and clear of opens, grounds and shorts between conductors. All wiring shall be l6 gauge or minimum size as determined by the manufacturer, copper. All wiring shall have a minimum insulation rating of 600 volts. All equipment shall be grounded with an approved earth ground wire being supplied at the control panel. All wiring shall be in conformance with Article 760 of the NFPA 70.

2.2.2 Wires in junction boxes and cabinets shall be permanently tagged and identified with metal or phenolic tags attached by nylon ties.

2.2.3 High temperature 50 ohms low loss coaxial cable shall be factory terminated. Field termination will not be allowed.

2.3 CONDUIT AND FITTINGS: Conduit and fittings shall conform to UL 1, UL 6, UL 514B, and UL 797 as appropriate for the application, and be the type and size indicated or as necessary to match the items being replaced.

2.4 OUTLET BOXES AND FITTINGS: Boxes and fittings shall be galvanized steel or cast aluminum and conform to UL 514A and UL 514B and be the type and size indicated or as necessary to match the items being replaced.

2.5 ENCLOSURES: Enclosures shall be painted steel and conform to UL 50 and be the type and size indicated or as necessary to match the items being replaced.

2.6 SURFACE METAL RACEWAYS AND FITTINGS: Surface metal raceways and fittings shall conform to UL 5, and be the type and size indicated or as necessary to match the items being replaced.

2.7 RADIO TRANSMITTING DEVICES: Radio transmitting devices shall comply with the applicable requirements of NFPA 72. Locations shall be as indicated and as otherwise specified.

2.8 MONACO EQUIPMENT: The existing base fire station utilizes two Monaco D-500 Plus Radio Controlled Fire Alarm Systems. Reuse existing Monaco BT2-3 transceiver equipment. All fire alarms, non-fire alarms and one common fire trouble alarm shall transmitted to the Fort Riley Fire Stations. Each alarm shall be identified by building number and zone description. The radio transceiver shall have the capability to transmit both alarms and trouble indications, omni-directional antenna, high temperature 50 ohms low loss coaxial cable for a complete and operable system in each designated building. All necessary equipment for transmission to base fire stations, shall be provided for alarm, individual zone and common trouble identification. **Note:** Products manufactured by Monaco are specified to establish existing Fort Riley Fire Alarm Base Transceiver System conditions, capacities, design features and quality, and are not intended to limit trade.

2.9 REMOTE ALARM TRANSCEIVER:

2.9.1 Remote Radio Alarm 3-Zone Transceiver: The remote radio alarm 3 zone transmitter shall be a microprocessor-controlled radio alarm transceiver. The operating program for the transceiver shall be stored in nonvolatile memory. In accordance with NFPA requirements, each transceiver shall provide connections for a minimum of three (3) per protected building zone with capability to transmit both alarms and trouble signals. Any unused zone inputs may be disabled to prevent invalid zone alarm and trouble transmissions. The Contractor shall install a Monaco Radio Transceiver BT2-3 for each group of 3 alarm zones. Radio alarm transceiver shall, without exception, meet or exceed the following requirements.

2.9.1.1 The Fort Riley Reporting Fire Alarm System shall be connected by one of two methods. The first method is to reinstall the existing Monaco BT2-3 transceiver system for each 3 zones. The first method shall have an independent BT antenna system with each BT system. The second method is to install a Monaco M1 FACP. The second method shall incorporate the fire alarm control panel and the building transceiver into a central control center with the capability of 58 class A alarm zones.

2.9.1.2 Remote radio alarm 3 zone transceivers and/or M1 FACP shall include a radio receiver and transmitter to allow interrogation/reply technique in which the transceivers are interrogated at regular time intervals automatically and replies are returned by the transceivers indicating the status of the transceiver. Transceivers shall also allow interrogation/reply initiated manually at the central station at any time.

2.9.1.3 Each remote radio alarm 3 zone transceiver and/or M1 FACP shall provide electrically supervised connections to the fire alarm panel, sprinkler system flow devices and such other alarm and supervisory devices indicated herein. Electrical supervision shall be for both open and ground conditions on interconnection wiring between the transceiver and fire alarm control panel or alarm or supervisory devices.

2.9.1.4 An alarm signal from the fire alarm control panel, water flow device, or other alarm device shall result in the transmission of an alarm signal to the central supervisory station. Alarm signals shall be transmitted three times to insure receipt. The alarm signal shall be coded to provide zone identification at the supervisory station. In addition, the transceiver shall light a red LED indicator identifying the zone on which the alarm condition has occurred. This indicator shall remain lighted as long as the alarm condition exists on the zone input. Additionally, the transceiver shall sound an audible alert for any alarm transmission. The audible alert shall sound at a distinct pulsating rate until acknowledged. The audible alert may be disabled at the discretion of the user.

2.9.1.5 A trouble condition on a local control panel or a break or ground in interconnecting wiring between the fire alarm control panel and transceiver shall result in transmission of a trouble signal to the central supervisory station. Trouble signals shall be transmitted two times to insure receipt. The trouble signal shall be coded to provide zone identification at the central supervisory station. In addition, the transceiver shall light a yellow LED indicator identifying the zone on which the trouble condition has occurred. This indicator shall remain lighted as long as the trouble condition exists on the zone input. Additionally, the transceiver shall sound an audible alert for any trouble transmission. The audible alert shall sound at a distinct pulsating rate until acknowledged. The audible alert may be disabled at the discretion of the user.

2.9.1.6 In accordance with NFPA 72 requirements, the restoration of alarm or trouble signals to normal condition shall result in a restoration signal being transmitted by the transceiver which indicates the return of the zone to the normal supervisory condition. The restoration signal shall be transmitted twice. In addition, the transceiver shall extinguish the associated zone alarm or trouble LED indicator.

2.9.1.7 The transceiver shall employ a selectable delay time of one (1) to fifteen (15) seconds during which the condition must remain on a zone input before the signal is transmitted to protect against transmission of intermittent conditions.

2.9.1.8 In addition to zone alarm and trouble transmission, each transceiver shall provide transmission of ac failure, low battery, or tamper conditions at the transceiver. The transmission shall be coded to indicate the specific condition and the transceiver number.

2.9.1.9 Transceivers shall be provided with a green LED indicator which shall have transceiver power status. The indicator shall be steady lighted to indicate the presence of ac input power and shall blink to indicate loss of ac power. Upon loss of ac power, switchover to backup power shall be automatic and shall not result in false transmissions. AC failure conditions at the transceiver shall not be transmitted until the condition has existed for sixty (60) seconds. Transmission of the ac failure condition may be inhibited at the discretion of the user. Inhibiting transmission of transceiver ac failure also inhibits transmission of zone troubles to prevent multiple trouble reports for an area wide power failure. An ac failure condition will be reported to the central station in response to an interrogation.

2.9.1.10 In accordance with NFPA requirements, each transceiver shall provide an emergency standby power supply capable of powering the unit for a minimum of twenty-four (24 hours) and (48 hours) for the M1 FACP, under conditions of loss of primary operating power. The transceiver emergency power supply shall consist of sealed cell, maintenance free batteries sized to provide the required standby operation and shall be connected across the power supply output. The transceiver power supply shall also provide a charger capable of recharging and maintaining the battery power, a reduction in battery voltage to 90 percent of its nominal terminal voltage shall result in transmission of a low battery signal to the Central Station. Transmission of a low battery signal while the transceiver is operating on ac power shall result if the battery leads are disconnected or if charger output is excessively high. For either condition, the transceiver shall light a red LED indicator identified as battery. If an ac failure condition exists, the blinking green LED indicator shall extinguish.

2.9.1.11 Where indicated on the drawings or equipment schedule, transceivers shall be provided with cover operated tamper switches. The tamper switch shall be connected to an input on the transceiver specifically designed for that purpose. Activation of the cover operated tamper switch shall result in transmission of a tamper signal. In addition, the transceiver shall light a red LED indicator identified as tamper.

2.9.1.12 The transceiver shall continue monitoring zone inputs during transmissions. If other conditions occur, the signals will be placed in an output buffer and queued according to priority. Interrogation replies shall have the highest priority. Alarm signals shall have priority over any non-alarm message. First transmission of a condition on a different zone may be transmitted between the second or third transmissions of an ongoing signal. If more than one condition occurs on one zone input while transmission is pending, only the alarm transmission will occur. If more than one non-alarm signal for one zone is pending, only the latest condition will be transmitted.

2.9.1.13 The transceiver shall include a four-digit LED display which will display the code for signals received by the transceiver. The last message received may be recalled to the display by manual switch activation. The LED readout will also display programmed information described in paragraph during programming and upon manual recall.

2.9.1.14 Transceivers shall provide for local testing of all indicators, the audible alert, and the radio transmitter and receiver through switch activation. Transceivers shall also provide for remote testing from the central station of the alarm signaling function. The remote test relay may optionally be used to activate an external auxiliary device.

2.9.1.15 Transceivers shall be equipped with a five tone transceiver, capability of transmitting codes above ZID Number 1023. NOTE: All ZID Numbers below 1023 are used and can not be assigned to new or replaced Building Transceiver Systems.

2.9.1.16 Transceivers shall provide for programming zone and transceiver numbers and operating options in the field without the use of tools. Zone and transceiver numbers shall be entered in decimal values. Entries shall be displayed on the four-digit LED display. Operating options shall include: Transceiver stand-alone; transceiver ac failure condition transmissions or transmissions inhibited; transceiver audible alert active or silent; zone fire or security alarm reporting; zone input active or disabled; zone delay time of 1 to 15 seconds. All programmed information shall be stored in a nonvolatile data module which is 1024 bit read/write memory with 10 year data retention capability. The module may be removed and installed on another transceiver for easy field replacement.

2.9.1.17 The transceiver shall include diagnostic test routines in the operating program. The routines shall test at least all switches, all LED indicators, the analog to digital converter, the transmitter, tone encoding, the remote test relay, the parallel port, the serial port, the digital LED display, and the audible alert.

2.9.1.18 Transceivers shall be installed in locations accessible for test and maintenance and which comply with the environmental parameters stated in the equipment specifications.

2.9.1.19 Transmitters and receivers shall employ crystal control timing and shall be provided assembled and tuned to eliminate any requirement for field adjustment.

2.9.1.20 Transceivers shall utilize frequency modulation (FM) transmission and shall operate on any assigned fixed frequency between 132 and 174 megahertz (MHz). Minimum output power shall be four (4) watts. RF transmitters shall be FCC type accepted and receivers shall meet the applicable requirements of the FCC rules and Regulations, part 15. Transmission time shall not exceed one second duration for each encoded transmission. Transmission and reception of encoded signals shall be indicated by separate LED indicators, which flash for each tone. Receivers shall provide carrier detect capability to identify other RF transmissions on the air when a signal is to be transmitted. Detection of carrier shall be indicated by a red LED. The microprocessor shall impose a variable delay on transmission when encoded tones are detected. The delay strategy employed shall be relevant to the transmission priority. Each transceiver shall contain a label inside of the enclosure indicating the operating frequency, serial number, FCC I.D. number, and other information required for identification.

2.9.1.21 Transponder is a radio device that receives an interrogating or challenging radio signal and automatically transmits a response on the same frequency. Fort Riley's assigned frequency is 138.925 MHz

2.10 REMOTE RADIO ALARM TRANSCEIVER INTERFACE DEVICE. An acceptable interfacing device or panel shall be utilized at each location where an auxiliary interconnection between a local fire alarm system within a given building or structure and a radio fire alarm transmitter has been made. The device may be incorporated as an integral portion of the radio alarm transmitters can be incorporated into the fire alarm control panel or it may be an independent self-contained unit. All interface devices shall comply with NFPA 72, and if used in any way for direct connection to an actuating device shall be UL or FM approved equipment or other nationally recognized testing laboratory, as a control unit. Interface devices shall be completely assembled, wired, tested at the factory, and delivery ready for installation and operation.

2.10.1 Connections: Interface devices shall be designed primarily for the purpose of connecting radio fire alarm transmitters to auxiliary or proprietary alarm system control panels utilizing form A dry contacts.

2.10.2 Enclosure: When furnished as an independent self-contained device, the interface device shall be incorporated into a red in color enclosure, conforming to NEMA ICS 1 type as required by its location. The interface housing shall be designed for universal mounting

2.10.3 Indicators: Devices shall provide indication of alarm and trouble conditions. Each such device shall provide a red fire alarm and an amber trouble light. The indicators will be designed to ensure visibility during daylight hours and to indicate the reporting zone.

2.10.4 Access: Switches and any other controls shall not be accessible without the use of a key. Access to controls shall be by unlocking and opening a panel or door.

2.10.5 Lock: Internal components shall be protected from vandalism by a tamperproof lock on the cabinet containing the interface device. Locks for all cabinets provided shall be key alike. The housing shall allow access to all internal components for testing, servicing, and replacement at the installation site.

2.11 REMOTE RADIO TRANSCEIVER ANTENNA: Reuse existing Monaco BSA-1 or equal antenna. Building mounted antennas shall be a 5/8 wave omni-directional; stainless steel; vertical polarization; 200 watt power rated; forward gain 3 dB, 5/8 wave ground plane; RF impedance, 52 ohms nominal; VSWR at resonance 1.3 to 1 maximum; 4 each Ground Radials; with an RF SO-239 Connector. The antenna and antenna mount shall be designed to withstand wind velocities of up to 125 mph. Each transceiver shall have its own antenna. Antennas shall be of noncorrosive materials and of strength suitable to withstand ice and wind loading conditions and shall be located well away from overhead power circuits and lightning systems. Antennas shall be factory cut to a frequency of 138.925 MHz. Antenna shall be provided complete with lightning arrester, coaxial cables, connectors, roof eve support bracket and all hardware and accessories for a complete functional installation.

2.12 ANTENNA MOUNTING: The antenna mount shall be a heavy duty wall mount type. Metal shall be galvanized heavy gauge steel with 1/4 inch drive-in anchor bolts minimum. The antenna shall be secured to a 1-inch rigid electrical conduit. The antenna and offset conduit shall be secured with the use of "U" type clamps and the mounts shall be mounted in pairs.

2.13 LIGHTNING ARRESTER: The lightning arrester shall have two RF SO-239 Connector; a cartridge type replaceable element, the cartridge which consists of two metal electrodes sealed in a gas-filled cylinder; isolated ground system, which permits direct earth connection while preventing are energy from being coupled to the equipment through the coax shield; cartridge is installed in a threaded hole and makes a solderless, pressure-fit connection, no disassembly or disconnection from the coaxial cable is necessary. The lightning arrester shall be mounted inside a rain-tight enclosure.

2.14 GROUND RODS: Ground shall be the sectional type, copper-encased, with a minimum diameter of 3/4 inch and a minimum of 10 feet. The ground rod shall have a hard, clean, smooth, continuous copper surface. The copper shall have a minimum wall thickness of 0.013 inch at any point on the rod. If ground rods are used they shall comply with the UL 467 requirements and NFPA 70. This applies to system not being installed in building sites, all transceiver system connected to building electrical system, the Contractor shall follow NFPA 70 for grounding.

2.15 PAINTING ON TRANSCEIVER AND INTERFACE PANEL: The transceiver and interface housing shall be factory painted with a suitable priming coat and not less than two coats of hard, durable, weatherproof enamel. The finish color shall be "fire engine red", similar to FStd 595 color 11105. Control boards shall be treated and painted in accordance with the manufacturer's standard practice. All paint surfaces damage during installation shall be repainted to match existing paint.

PART 3 EXECUTION

3.1 GENERAL: Install the remote radio transceiver system as indicated on the plans and specified herein. The remote transceiver system shall be compatible without modification to the existing Monaco Central Fire Radio Alarm Transceiver System and be NFPA certified.

3.2 INSTALLATION: Install the remote radio transceiver system in accordance with NFPA 70, NFPA 72 and NFPA 1221, the manufacturer's written installation instructions, approved shop drawings, and the requirements herein. Refer to U.S. Army Corp of Engineers Technical Exhibits (TE) 17C-1 thru 17C-6 for examples on connecting the radio transceiver to the existing FACP and the different type of antenna installations.

3.2.1 Programming ZID Numbers: Prepare and submit a list of required zones for each building to the PW FPPD located at Building 5000, 10 day prior to programming the BT transceiver. PW FPPD personnel will program the central control fire alarm computer system and furnish the Contractor with the required programmed ZID numbers. Test the system for the correct ZIDs numbers for each zone.

3.2.2 Mounting Height For Control Panels: Mount the remote radio alarm transceiver panel between 48 to 78 inches from top of panel to finished floor. Use galvanized bolts washers and locking nuts to mount the transceiver, a minimum of 3/4 inch shall be between the radio transceiver enclosure and the wall mounting surface.

3.3 OPERATION: The FDAS shall automatically initiate fire alarm signals whenever any manual, automatic fire detecting devices is placed into an alarm mode or system is placed in a self-test request. The system shall indicate areas in alarm on the main FACP, annunciator panel and remote radio alarm transceiver panel. If a fire or trouble alarm is activated, the remote radio alarm transceiver will send a coded message to the central fire alarm system. Alarm indication at the fire station shall be by each zone including self-test per building. Common trouble indication at the fire station shall be by building.

3.4 WIRING AND COAXIAL CABLE:

3.4.1 Wiring: The system wiring shall be electrically supervised. The Contractor and his manufacturer's Representative shall be required to properly size and install the number of wires required to operate remote radio fire alarm equipment accordance to this contract. The minimum size shall be 14 gauge copper wire. The installation of wiring and equipment shall be in accordance with NFPA 70, Article 760. The transceiver shall transmit a trouble signal, if the transceiver system wiring is affected, but shall not affect the operation of the fire alarm system if an open, ground, or short circuit fault occurs. Power wiring and control wiring shall be isolated.

3.4.2 Circuit Identifications: Install two different wire colors for each alarm circuit; one for each loop. Wiring colors shall remain uniform throughout the circuit and all termination’s and splices shall be uniquely and permanently marked in accordance to submitted number system.

3.4.3 Coaxial Cable: The high temperature 50 ohms low loss coaxial cable shall be factory terminated, field termination will not be allowed. The coaxial cable shall be installed in electric metallic tubing from the BT 2 transceiver to the NEMA 3R coaxial lightning arrester enclosure, (minimum size shall be 3/4 in). The conduit shall be primed and painted to match the surface installed on. When installed on brick, the conduit shall be primed and painted a medium brown matching the gutters but medium tan on native limestone.

3.5 REMOTE RADIO TRANSCEIVER ANTENNA: Antenna shall be Monaco BSA-1 or equal, omni-directional, roof eve mounted. Antenna shall be provided complete with lightning arrester system. Install the 50-ohm Omni-directional antenna on an approved building mount. The mount shall be a minimum of 6 feet from any building opening and 10 feet from any lightning protection equipment other than its own.

3.6 AC POWER SUPPLY: AC power supply for the alarm systems shall be a single dedicated branch circuit with surge protection. Install a new disconnect for the fire alarm and radio transceiver. The wiring shall be installed in electric metallic tubing (EMT), from the BT 2 transceiver to the electrical distribution panel for each building system.

3.7 BATTERY BACKUP SUPPLY: Furnish a minimum battery power for loss of AC power of 24 hours for BT2-4-16 transceivers and 48 hours for M1 FACP.

3.8 LIGHTNING ARRESTER AND GROUNDING ROD: The grounding shall be completed by two methods. The first method the Contractor shall install a minimum #6 AWG solid bare copper wire from the arrester to the 3/4 by 10 ft rod driven 12 inches below finished ground surface. The wire shall be protected by a 1/2 inch PVC schedule 40 electrical conduit from 12 inches below ground surface to a minimum of 8 feet above ground surface. The conduit shall be strapped every 2 feet, and sealed at top of conduit with duct seal. The bare #6 copper wire from the arrester to the conduit shall be strapped with copper one hole straps, #8 brass screws and nylon drive-in anchors every 2 feet minimum. The second method the Contractor shall connect the system to the building grounding system in-according to NFPA 70.

3.9 TESTING AND SPECIFICATIONS: Notify the Contracting Officer 10 calendar days before the performance and acceptance tests are to be conducted. The tests shall be performed in the presence of the COR, PW FPPD, PW OMD FDAS technicians, and the FDAS components manufacturer's factory representative. Furnish all instruments and qualified personnel required for the tests. Any tests rescheduled due to Contractor's deficiencies causing the testing to be suspended or delayed, the Contractor shall be charged $300.00 for each delay.

3.9.1 Performance Tests: Upon completion of the installation, the system shall be subjected to complete functional and operational performance tests. When all corrections are made, the system shall be re-tested to assure that it is functional.

3.9.2 Acceptance Test For Radio Transceivers: Submit proposed test procedures for approval at least 10 calendar days prior to commencement of acceptance testing. The test shall be reconducted to verify correction of any defect found in the initial testing. The system shall be certified and all testing shall be in accordance with NFPA 72. Furnish the "Fire Alarm System Certification and Description" from NFPA 72. The manufacturer's representative shall be required to sign the "Certification of System Installation" and the Contractor shall sign the "Certification of System Operation, in addition the following test shall be completed. The test shall include the following.

3.9.2.1 Test of each function of the control panel.

3.9.2.2 Tests of the battery charger and batteries.

3.9.2.3 Complete operational tests under emergency power supply.

3.9.2.4 Visual inspection of all wiring.

3.9.2.5 Opening the circuits between the fire alarm control panel and transceiver to test the wiring supervisory feature.

3.9.2.6 Test and record the radio transceiver for RF output with a RF Power Wattmeter.

3.9.2.7 Test and record the radio transceiver for RF output with a Field Strength meter.

3.9.2.8 Test and record the radio transceiver for Frequency with a Frequency Counter meter.

3.9.2.9 Test each fire alarm, non fire alarm and trouble alarm zone for correct identifications from the FACP and the Fort Riley's Fire Station central fire alarm computer systems.

3.9.2.10 Self-test the radio transceiver from the Main Fire Station Building 5000.

3.10 ACCEPTANCE OF TESTING: Criteria for testing shall be as follows:

3.10.1 Visual Units: Visual units shall be illuminated on alarm and remain illuminated until system is reset.

3.10.2 Panels and Supervisory Devices: Panels and supervisory devices shall display and control functions as specified.

3.11 RETESTING: Reconduct tests to verify corrections of any defects found in the initial testing.

DIVISION 16 - ELECTRICAL

SECTION 16740

VOICE AND DATA SYSTEM

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation of a voice and data system required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 Electronic Industries Alliance (EIA-TIA) Standards and (TSB) Telecommunication Systems Bulletins:

568-A	Commercial Building Telecommunications Wiring Standard.
569-A	Commercial Building Standard for Telecommunications Pathways and Spaces.
606	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
607	Grounding and Bonding Requirements for the Telecommunications Infrastructure of Commercial Buildings.
TSB 36	Additional Cable Specifications for Unshielded Twisted Pair Cables.
TSB 40-A	Additional Transmission Specifications for Unshielded Twisted-Pair Connecting Hardware.
TSB 67	Transmission Performance Specifications for Field Testing of UTP Cabling Systems.
I3A	Department of the Army Technical Guide for Installation Information Infrastructure Architecture (13A) Implementation Version 2

1.2.2 Insulated Cable Engineers Association (ICEA) Publication:

S-80-576	Communications Wire and Cable for Wiring of Premises.

1.2.3 IBM Publication Corporation (IBM) Publications:

GA27-3361-07	LAN Cabling System - Planning and Installation.
GA27-3773-1	Cabling System Technical Interface Specifications.

1.2.4 National Electrical Manufacturers Association (NEMA) Publications:

VE 1	Metal Cable Tray Systems.

1.2.5 National Fire Protection Association (NFPA) Publication:

70	National Electrical Code (NEC).

1.2.6 Underwriters Laboratory (UL) Publications:

1	Flexible Metal Conduit.
3	Flexible Nonmetallic Tubing for Electric Wiring.
5	Surface Metal Raceways and Fittings.
6	Rigid Metal Conduit.
50	Enclosures for Electrical Equipment.
83	Thermoplastic-Insulated Wires and Cables.
514A	Metallic Outlet Boxes.
514B	Fittings for Conduit and Outlet Boxes.
651	Schedule 40 and 80 Rigid PVC Conduit.
651A	Type EB and A Rigid PVC Conduit and HDPE Conduit.
797	Electrical Metallic Tubing.

1.2.6 U.S. Department of Commerce Product Standard (PS):

PS 1	Construction and Industrial Plywood.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section. Lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of detail drawings, 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, and a list of spare parts recommended for stocking. Provide an additional list to Ft. Riley DOIM.

1.3.2 Certification: Submit certification that the premises distribution system fully complies with the EIA 568-A, EIA 569-A, EIA 606, EIA TSB 36, and EIA-TSB 40-A standards. Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, 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.

1.3.3 Qualifications: Submit qualifications of the manufacturer(s), contractor(s), and installer(s) to perform the work specified herein. This shall include proof of the minimum qualifications specified herein.

1.3.4 Installation, Operation, and Maintenance Instructions: Submit manufacturer's written installation, operation, and maintenance instructions. 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 shall be provided. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

1.3.5 Shop Drawings: Submit detailed shop drawings including a complete list of equipment and material. Detail drawings shall contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include vertical riser diagrams, equipment rack details, elevation drawings of telecommunications closet walls, outlet face plate details for all outlet configurations, sizes and types of all cables, conduits, and cable trays. 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 operation. System drawings and records showing final configuration, including location, type, block, panel and terminal assignment of cabling in accordance with EIA 606, and floor plan layout of the equipment room. Route through Ft. Riley DOIM.

1.3.6 Test Plan: Submit a test plan defining the tests required to ensure that the system meets technical, operational and performance 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 the setup and execution of each test and procedures for evaluation and documentation of the results.

1.3.7 Test Reports: Submit test reports in booklet form with witness signatures verifying execution of tests. Test results will also be provided on 3 1/2 inch diskettes in ASCII 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 verified during testing. Test reports shall be submitted within 7 days after completion of testing.

1.3.8 As-Built Drawings: Submit as-built drawings for all work performed under this section. Provide an additional copy to Ft. Riley DOIM.

1.4 QUALIFICATIONS:

1.4.1 Minimum Contractor Qualifications: 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:

1.4.1.1 Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.

1.4.1.2 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.

1.4.1.3 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.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.1.1 System Description: The voice and data system shall consist of inside-plant horizontal, riser, and backbone cables and connecting hardware to transport voice and data signals between equipment items within the building.

2.1.2 Environmental Requirements: Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F. and in the range of 0 to 95 percent relative humidity, noncondensing.

2.2 CABLE AND WIRING: Electrical cable shall conform to UL 83 and be the type and size indicated or as necessary to match the items being replaced.

2.3 CABLE TRAYS: Cable trays shall conform to NEMA VE 1 and be the type and size indicated or as necessary to match the items being replaced.

2.4 CONDUIT AND FITTINGS: Conduit and fittings shall conform to UL 1, UL 3, UL 6, UL 514B, UL 651, UL 651A, and UL 797 as appropriate for the application, and be the type and size indicated or as necessary to match the items being replaced. Minimum size of conduit is 3/4 inch ID.

2.5 EQUIPMENT BACKBOARDS: Equipment mounting backboards shall be 3/4 inch thick B-C grade plywood and conform to PS 1. Fasten plywood backboards to framing and/or walls 24 inches o.c. around perimeter and in-the-field. Plywood backboards shall be the size indicated, and primed and painted with white or light colored paint.

2.6 EQUIPMENT RACKS:

2.6.1 Cable Guides: Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 19 or 23 inch equipment racks as indicated. 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 lockwashers.

2.6.2 Floor Mounted Open Frame: Floor mounted equipment racks shall be welded steel or aluminum relay racks with uprights to mount equipment 19 or 23 inches wide as indicated. Uprights shall be 3 inch deep channel, 1-1/4 inches wide, drilled and tapped 12-24 in a 1/2 inch pattern. Racks shall be provided with a standard top crossmember, and predrilled base plate to allow floor fastening. Open frame equipment racks shall be 7 feet in height and painted. AC outlets shall be provided as shown.

2.6.3 Floor Mounted Cabinets: Equipment cabinets shall be floor mounted enclosures with side panels, acrylic plastic front doors, rear louvered metal doors, depth-adjustable front and rear mounting rails, and louvered top. Ventilation fans will be included when indicated. Vertical cable management devices shall be integral to the cabinet. Power strips with 6 outlets shall be provided within the cabinet. Equipment racks shall mount equipment 19 or 23

inches wide as indicated and shall be 72 inches high and 30 inches deep. Cabinet exteriors shall be painted beige or gray.

2.6.4 Wall Mounted Open Frame: Wall mounted open frame equipment racks shall be steel or aluminum relay racks to mount equipment 19 or 23 inches wide as indicated with standoff brackets for wall mounting. Uprights shall be drilled and tapped 12-24 in a 1/2 inch pattern. Standoff brackets shall be of sufficient length for a 6 inch clearance between rack and wall. Wall mounted open frame racks shall be hinged. AC outlets shall be provided as shown.

2.6.5 Wall Mounted Cabinets: Wall mounted cabinets shall conform to UL 50 and have boxes constructed of zinc-coated sheet steel with dimensions not less than those indicated. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum openings to the box interiors. Boxes shall be provided with 3/4 inch plywood backboard painted white or a light color. A duplex AC outlet shall be installed within the cabinet.

2.7 OUTLET BOXES AND FITTINGS: Boxes and fittings shall be galvanized steel or cast aluminum and conform to UL 514A and UL 514B, and be the type and size indicated or as necessary to match the items being replaced. Boxes for telecommunication outlets shall be 4-11/16 inches square by 2-1/8 inches deep with minimum 3/8 inch deep single or double gang plaster rings.

2.8 SURFACE METAL RACEWAYS AND FITTINGS: Surface metal raceways and fittings shall conform to UL 5, and be the type and size indicated or as necessary to match the items being replaced.

2.9 UNSHIELDED TWISTED PAIR CABLE SYSTEM:

2.9.1 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.

2.9.2 Riser Cable: Riser cable shall meet the requirements of ICEA S-80-576 and EIA 568-A for Category 3 100-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] [22 AWG]. Cable shall be rated [CMR] [CMP] per NFPA 70.

2.9.3 Horizontal Cable: Horizontal cable shall meet the requirements of EIA 568-A for Category [3] [5] [3 or 5 (as indicated)] 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 [CMG] [CMP] per NFPA 70.

2.9.4 Connecting Hardware: Connecting and cross-connecting hardware shall be the same category as the cable it serves. Hardware shall be in accordance with and EIA 568-A and TSB 40-A.

2.9.4.1 Telecommunications Outlets: Combination telephone/data 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". Modular jacks shall be the same category as the cable they terminate and shall meet the requirements of EIA 568-A and EIA TSB 40-A. Modular jack pin/pair configuration shall be

T568A per EIA 568-A and EIA TSB 40-A. Modular jacks shall be unkeyed. Faceplates shall be provided and shall be ivory in color, impact resistant plastic. Mounting plates shall be provided for system furniture and shall match the system furniture in color. Outlet assemblies used in the premises distribution system shall consist of modular jacks assembled into duplex outlet assemblies in single gang covers as specified in this section and as indicated on the drawings. The modular jacks shall conform to the requirements of EIA 568-A, EIA TSB 40-A, Category 5.

2.9.4.2 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 19 or 23 inch rack mounted or wall mounted panels as indicated. Jack pin/pair configuration shall be [T568A] [T568B] per EIA 568-A. Jacks shall be [unkeyed] [keyed] [keyed or unkeyed as indicated]. Panels shall [be labeled with alphanumeric x-y coordinates] [be provided with labeling space].

2.9.4.3 Patch Cords: Patch cords shall be cable assemblies consisting of flexible, twisted pair stranded wire with eight-position plugs at each end. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals 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] [T568B] patch panel jack wiring per EIA 568-A. Patch cords shall be [unkeyed] [keyed] [keyed or unkeyed as indicated]. Patch cords shall be factory assembled.

2.9.4.4 Terminal Blocks: Terminal blocks shall be wall mounted wire termination units consisting of insulation displacement connectors mounted in plastic blocks, frames or housings. Blocks shall be type 110 which meet the requirements of EIA 568-A and EIA TSB 40-A for Category 5. Blocks shall be mounted on standoffs and shall include cable management hardware. Insulation displacement connectors shall terminate 22 AWG solid copper wire as a minimum, and shall be connected in pairs so that horizontal cable and connected jumper wires are on separate connected terminals.

2.10 SHIELDED TWISTED PAIR CABLE SYSTEM:

2.10.1 Backbone Cable: Backbone cable shall meet the requirements of IBM GA27-3773-0 for 150 ohm shielded twisted pair cable and shall meet or exceed IBM performance requirements for Type 1A cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated [CMP] [CMR] [CMG] per NFPA 70.

2.10.2 Horizontal Cable: Horizontal cable shall meet the requirements of IBM GA27-3773-0 for 150 ohm shielded twisted pair cable and shall meet or exceed IBM performance requirements for Type 1A cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated [CMG] [CMP] per NFPA 70.

2.10.3 Connecting Hardware:

2.10.3.1 Connectors: Connectors for shielded twisted pair cable shall meet the requirements of EIA 568-A for media interface connectors and IBM GA27-3773-0 for Type 1A data connectors. Connectors shall be of hermaphroditic design and shall be utilized for outlets and patch panel terminations. Outlet faceplates shall be provided and shall be ivory [stainless steel], [double gang]. Mounting plates shall be provided for systems furniture and shall match the systems furniture in color.

2.10.3.2 Patch Panels: Patch panels shall be 19 or 23 inch rack or wall mounted as indicated with openings for shielded twisted pair connectors. Panels shall be [metallic and shall ground the outer shield of the cable] [non-metallic]. Patch panels shall provide strain relief for cables. Panels shall [be labeled with alphanumeric x-y coordinates] [be provided with labeling space].

2.10.3.3 Patch Cords: Patch cords shall be cable assemblies consisting of flexible shielded twisted pair cable with shielded twisted pair type connectors at each end. Cable shall meet the requirements of IBM GA27-3773-0 for 150 ohm Shielded Twisted Pair Cable and shall meet or exceed performance requirements for Type 6A patch panel data cable. Connectors shall meet or exceed the requirements of EIA 568-A for media interface connectors. Patch cords shall be factory assembled.

2.11 COAXIAL CABLE SYSTEM:

2.11.1 Backbone Cable: Backbone cable shall meet the requirements of EIA 568-A 10BASE5 for coaxial cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated [CMP] [CMR] [CMG] per NFPA 70. Cable shall have band markings every 8 feet for transceiver tap placement.

2.11.2 Horizontal Cable: Horizontal cable shall meet the requirements of EIA 568-A 10BASE2 for coaxial cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated [CMP] [CMG] per NFPA 70.

2.11.3 Connecting Hardware:

2.11.3.1 Connectors: Connectors shall meet the requirements of EIA 568-A 10BASE5 or 10BASE2 for coaxial cable connectors, as required for the service. [Connectors for riser/backbone cable shall be Type N male.] [Connectors for station cable shall be BNC male.] Station cable faceplates shall be provided and shall be [ivory], [stainless steel], [double gang], with double-sided female BNC coupler. Mounting plates shall be provided for system furniture and shall match the furniture system in color.

2.11.3.2 Patch Panels: Patch panels shall be 19 or 23 inch rack mounted or wall mounted as indicated. Connectors shall be double-sided BNC female, feedthrough type. [Connector mounting surface shall ground the connector shields.] BNC feedthrough connectors shall meet the requirements of EIA 568-A 10BASE2 for coaxial cable connectors. Panels shall [be labeled with alphanumeric x-y coordinates] [be provided with labeling space].

2.11.3.3 Patch Cords: Patch cords shall be cable assemblies consisting of flexible coaxial cable with BNC male connectors at each end. Cable shall meet the requirements of EIA 568-A 10BASE2 for coaxial cable. Connectors shall meet the requirements of EIA 568-A 10BASE2 for coaxial cable connectors.

2.12 FIBER OPTIC CABLE SYSTEM:

2.12.1 Backbone Cable:

2.12.1.2 Singlemode: Singlemode fiber optic backbone cable shall meet the requirements of ICEA S-83-596 and the following: operation at a center wavelength of [1,550] [_____] nm; core/cladding diameter 8.3 nominal/125 micrometer; maximum attenuation, 1.75 dB/km at 1,550 nm]. Numerical aperture for each fiber shall be a minimum of 0.10. Cable construction shall be tight buffered type. Cable shall be imprinted with fiber count and aggregate length at regular intervals. Individual fibers shall be color coded for identification. Cable shall be rated [OFNR] [OFNP] [OFNG] per NFPA 70.

2.12.2 Horizontal Distribution Cable:

2.12.2.2 Singlemode: Singlemode fiber optic horizontal cable shall meet the requirements of ICEA S-83-596 and the following: operation at a center wavelength of [1,550] nm; core/cladding diameter 8.3 nominal/125 micrometer; maximum attenuation, 1.75 dB/km at 1,550 nm]. Numerical aperture for each fiber shall be a minimum of 0.10. Cable construction shall be tight buffered type, two strands. Individual fibers shall be color coded for identification. Cable shall be imprinted with fiber count, fiber type, and aggregate length at regular intervals of [2][2] feet. Cable shall be rated and marked [OFNP] per NFPA 70.

2.12.3 Connecting Hardware:

2.12.3.1 Connectors: Connectors shall be [ST] type with ceramic ferrule material with a maximum insertion loss of .5 dB. Connectors shall meet performance requirements of 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. Station cable faceplates shall be provided and shall be [_____] in color, [stainless steel] [_____], [double gang], with double-sided female [ST] coupler. Mounting plates shall be provided for system furniture and shall match the furniture system in color.

2.12.3.2 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 19 or 23 inch rack mounted or wall mounted as indicated. 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.

2.12.3.3 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.

PART 3 EXECUTION

3.1 GENERAL: Install a voice and data system as indicated on the plans and specified herein.

3.2 INSTALLATION: Install the voice and data system components and appurtenances in accordance with EIA 568-A, the manufacturer's written installation instructions, the contractor's approved shop drawings, and the requirements herein. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Conduits, raceways, wiring, and outlets shall be installed in accordance with NFPA 70 and SECTION 16050, ELECTRICAL. Components shall be labeled in accordance with

EIA 606. Wiring, and terminal blocks and outlets shall be marked in accordance with EIA 606. Penetrations in fire-rated construction shall be firestopped in accordance with SECTION 07270, FIRESTOPPING. 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.

3.2.1 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 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 8 inches above ceilings by cable supports no greater than 60 inches 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 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. In raised floor areas, cable shall be installed after the flooring system has been installed. Cable 6 feet long shall be neatly coiled not less than 12 inches in diameter below each feed point in raised floor areas.

3.2.2 Riser and Backbone Cable: Vertical cable support intervals shall be in accordance with manufacturer's 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.

3.2.3 Telecommunications Outlets:

3.2.3.1 Faceplates: As a minimum each jack shall be labeled as to its function and a unique number to identify cable link.

3.2.3.2 Cables: CAT 5 cables shall have a minimum of 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.

3.2.3.3 Pull Cords: Nylon pull cords shall be installed in all conduits serving telecommunications outlets which do not initially have cable installed.

3.2.3.4 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.

3.2.3.6 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 [3] feet in length.] [provided 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.

3.2.3.7 Equipment Racks: 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 rack 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.

3.2.3.8 Rack Mounted Equipment: Equipment to be rack mounted shall be securely fastened to racks by means of the manufacturer's recommended fasteners.

3.3 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.

3.2.2 Shielded Twisted Pair Cable: Each cable shall be terminated on panel-mounted connectors. Cables shall be grounded at patch panels using manufacturer's recommended methods. Shield braid shall be continuous to connector braid terminator. Wire insulation shall not be damaged when removing shield.

3.2.3 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.

3.2.4 Fiber Optic Cable: Each fiber shall have connectors installed. The pull strength between the connector and the attached fiber shall be not less than [25]pounds. The mated pair loss, without rotational optimization, shall not exceed [1.0] dB. Fiber optic connectors shall be installed per EIA 568-A.

3.4 GROUNDING: Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunications closet in accordance with EIA 607 and SECTION 16050, ELECTRICAL. Equipment racks shall be connected to the electrical safety ground.

3.5 ADDITIONAL MATERIALS: Furnish the following additional materials required for facility startup.

3.5.1 10 of each type outlet.

3.5.2 10 of each type cover plate.

3.5.3 1 of each type terminal block for each telecommunications closet.

3.5.4 4 Patch cords of 10 feet for each telecommunications closet.

3.5.5 1 Set of any and all special tools required to establish a cross connect and to change and/or maintain a terminal block.

3.6 ADMINISTRATION AND LABELING:

3.6.1 Labels: All labels shall be in accordance with EIA 606.

3.6.2 Cable: All cables will be labeled using color labels on both ends with [encoded] [unencoded] identifiers per EIA 606.

3.6.3 Termination Hardware: All workstation outlets and patch panel connections will be labeled using color coded labels with [encoded] [unencoded] identifiers per EIA 606.

3.7 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.

3.7.2 Shielded Twisted Pair: Wiring configuration shall be tested for continuity, opens, shorts, swaps and correct pin configuration; dc resistance both pair-to-pair and wire-to-shield shall be verified. Cable lengths shall be verified. Near end crosstalk shall be tested from 772 kHz to 300 MHz. Ground potential difference between wiring closets, ground potential difference between patch panel and wall outlet, and ground path resistance shall be tested per IBM GA27-3361-07.

3.7.3 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.

3.7.4 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 reterminated if any of these conditions exist. Each circuit leg and complete circuit shall be tested for insertion loss at [1,310 and 1,550] 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 80 percent of the X-axis.

3.7.5 Category 5 Circuits: All category 5 circuits shall be tested using a test set that meets the Class II accuracy requirements of EIA TSB 67 (Draft) standard. Testing shall use the Basic Link Test procedure of EIA TSB 67. Cables which contain failed circuits shall be replaced and retested to verify the standard is met.

DIVISION 16 – ELECTRICAL

SECTION 16775

AUDIO VISUAL SYSTEMS

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation of audio and visual systems required in this project. All requirements of the construction are applicable to this section. Each contractor is responsible to be thoroughly familiar with all its contents pertaining to this section. Coordinate all items with COR to insure that all items furnished in accordance with COR's standards.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this specification to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 American National Standards Institute (ANSI) Standards:

1.2.2 Electronics Industries Alliance (EIA-TIA) Standards:

SE-101-A	Amplifier for Sound Equipment.
SE-103	Speaker for Sound Equipment.
SE-105	Microphones for Sound Equipment.
160	Sound Systems.
215	Broadcast Microphone Cables.
297-A	Cable Connectors for Audio Facilities for Radio Broadcasting.
310-D	Cabinets, Racks, Panels, and Associated Equipment.

1.2.3 Federal Communications Commission (FCC) Publications:

1.2.4 National Association of Broadcasters (NAB) Publications:

1.2.5 National Cable Television Association (NCTA) Publications:

1.2.6 National Electrical Manufacturers Association (NEMA) Publication:

VE 1	Metal Cable Tray Systems.

1.2.7 National Fire Protection Association (NFPA) Publications:

70	National Electrical Code (NEC).

1.2.8 Society of Motion Picture and Television Engineers (SMPTE) Publications:

1.2.9 Underwriters Laboratory (UL) Publications:

1	Flexible Metal Conduit.
3	Flexible Nonmetallic Tubing for Electric Wiring.
5	Surface Metal Raceways and Fittings.
6	Rigid Metal Conduit.
50	Enclosures for Electrical Equipment.
83	Thermoplastic-Insulated Wires and Cables.
514A	Metallic Outlet Boxes.
514B	Fittings for Conduit and Outlet Boxes.
651	Schedule 40 and 80 Rigid PVC Conduit.
651A	Type EB and A Rigid PVC Conduit and HDPE Conduit.
797	Electrical Metallic Tubing.

1.3 SUBMITTALS:

1.3.1 Product Data Sheets and List of Materials: Submit a manufacturer's product data sheets and a certified list of materials for all major materials proposed for use in work under this section.

1.3.2 Installation, Operation, and Maintenance Instructions: Submit manufacturer's written installation, operation, and maintenance instructions.

1.3.3 Shop Drawings: Submit shop drawings for the following:

- Complete details and dimensions of work to be performed.
- Locations of equipment racks and equipment location and layout.
- Wire termination schedule.
- Detail any custom assemblies.
- Drawings to show evidence of coordinating with other trades.
- Submit four manuals including warranties, guarantees, and operating instructions.
- Schematic diagrams including all wiring labels.

1.3.4 As-Built Drawings: Submit as-built drawings for installation of new components. Submit as-built drawings for additions and changes to electrical systems.

1.4 RESPONSIBILITIES AND RELATED WORK: Coordinate scheduling of work with the COR.

1.4.1 Audio Visual Contractor (AV/C) is responsible for:

- The installation and cabling of all equipment racks.

- Supply of all accessories and minor equipment needed for a complete operational system, even if not specifically mentioned herein or on the drawings, without additional compensation.
- Equipment rack finishes will be coordinated with COR so as to match room decor.
- Verification of exact number of rack spaces for all equipment and the provision of a service lamp in the top of each rack.
- Providing the electrical contractor verification of all conduit fills for audio and video cables.
- Provide the Electrical Contractor any special needs back boxes (i.e. back boxes for touch-panels).
- Termination of all cables related to the audio and video systems including interconnection to all equipment, wall plates, and rack panels.
- Testing and proper equalization adjustment for complete and properly operating systems.
- Installation of all speakers and equipment and remotes.
- Provide on site supervision for all cable pulls provided by the electrical contractor.

1.4.2 Electrical Contractor (E/C) is responsible for:

- Provision and installation of AC power circuits, outlets and power panels.
- Supply and installation of all conduits, gang boxes, pull boxes, wall panel back boxes, pull-string and raceways required for the audio and video systems.
- Provision and installation of all cable. All wire will be labeled, and the AV Contractor prior to installation shall verify type and quantity of cables.
- Labeling of all wiring installed fro the AV systems, and will promptly prepare and forward to the AV Contractor a complete run list of the cable numbers as the cable is installed. They will be logically, legibly and permanently labeled for easy identification. The AV Contractor will use these numbers in preparation of their own labels to comply with this specification.

1.5 HAZARDOUS MATERIALS NOTIFICATION: In the event that no product or material is available that does not contain asbestos, PCB or other hazardous material as determined by the owner, a "Materials Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

1.6 ASBESTOS AND PCB CERTIFICATION: Prior to substantial completion, contractor shall certify in writing that materials installed and processes used do not contain asbestos or PCBs

1.7 QUALITY ASSURANCE:

1.7.1 Contractor will have installed at least three similar jobs in the last five years, and provide at least one such completed job for inspection by the COR. This information will be provided in the bid proposal.

1.7.2 Contractor will have a minimum of five years experience with the type of systems specified.

1.7.3 Contractor will maintain a fully staffed and equipped service facility and be an authorized dealer and service center for all major components.

1.7.4 Lead Installer and Lead Engineer shall each have no less than three years experience with systems of the type and magnitude specified.

1.8 WARRANTY:

1.8.1 Contractor shall warrant all equipment to be free of defects in material and workmanship for not less than one year from the date of acceptance. Defects occurring in labor or materials within the warranty period shall be rectified by repair or replacement. Within the warranty period, the contractor shall provide answers to request for information, service calls and repair or replace any faulty equipment in not more than 72 hours, and provide the all contact names and numbers for service issues.

1.8.2 This warranty shall not void specific warranties provided by manufacturers for longer periods of time.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.1.1 Identical Items: Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.

2.1.2 Nameplates: Each major component of equipment shall have the manufacturer's name, address, model and catalog number, and serial number on a plate secured to the equipment.

2.2 SYSTEM DESCRIPTION:

2.2.1 Video System Description: There will be 7 individual AV systems. One will be located in the control one of Rooms 170, 107A, 108, 108A and 118. In Rooms B09 and B03, the equipment will be stored in a cabinet located in or near the room. If located in the room, the cabinet will part of the room decor. The video system will consist of a switcher/scalers with audio-follow-video located in each room with its output fed to an RGBHV DA, then to the projector and to the building AV matrix switcher. Inputs to the projection switchers will include graphics computers, video playback sources and an available input for video cameras to be added at a later date. The graphics computers shall input either locally or from connections located about the perimeter of each room. Control of the projector will come from either an RS 232 control system or the manufacturer's wired remote. The projector must be a dual lamp design. The projector must have a mechanical light shutter. The building AV matrix switcher will be an RGBHV with audio-follow-video. This switcher will be operated either locally or via RS 232 remote. Any remote operation of the switcher must be done via a logical and intuitive control panel that will allow the owner to combine and configure rooms in any combination. Outputs are then returned to the rooms for presentation.

2.2.2 Audio System Description: The audio system will consist of 7 individual digital auto-mixers with onboard DSP based processing located in each room. The system will accept four transformer-isolated mic inputs from the

room, audio playback sources, a wireless mic, the output from the video switcher. The output of the mixer will then be fed to an assistive listening system, a power amplifier for the rooms' loudspeakers, to a remote monitoring station to be located at or near the facility coordinators office, and to the building AV matrix switcher. Loudspeaker system shall be a 70 volt distributed configuration. Speakers shall be sufficient in number and quality to support reasonable anticipated room functions (dinners and presentations). The AV contractor will provide a portable sound system per the drawings to support functions with more extensive audio requirements as an Add Alternate.

2.2.3 Background Music and Paging System: The background music and paging will consist of a digital mixer/amplifier that will be located in Room 111 and accept inputs from a variety of audio playback sources and output to three separate zones. It will provide a zone addressable paging microphone. Each zone will have an independent remote. A zone will be designated as a pool feed and will be able to select Room B09 as its source. Loudspeakers shall be located in the hallways and restrooms and powered from a 70 volt amplifier.

2.2.4 Audio Monitoring Station (Room 111): A simple monitoring station will be provided to allow the facility manager to select and listen to the audio output from each of the of the conference rooms.

2.2.5 Portable Music System: One or more portable music systems will be provided as an add alternate. The system will be capable of providing support for small music groups. It will have a stereo house mix and capable of two monitor mixes. A third mix will be available for effects processing. One stereo effects processor will be included. All speakers (two front speakers and two monitor speakers) will be active enclosures. All equipment shall be rack-mounted for ease of use and transport. The AV Contractor will budget $3,000.00 for a selection of microphones, stands, cords, and direct boxes for use in support of musical performances. A 100 foot 20 channel snake providing 16 sends and 4 returns. System will also include all appropriate cases for transport.

2.3 CABLE AND WIRING:

2.3.1 General: Electrical cable shall conform to UL 83 and be the type and size indicated or as necessary to match the items being replaced.

2.3.2 Speaker and Microphone: Speaker and microphone cable shall conform to EIA-TIA RS 215 and RS 297-A. Cables shall be of the gauge required depending upon the cable run length. In no case shall any cable be used which is smaller than 20 gauge. Insulation on the conductors shall be polyvinyl chloride (PVC) or an equivalent synthetic thermoplastic not less than 0.009 inch. Cables shall be shielded with a 34 gauge tinned soft copper strand formed into a braid. Cables shall be jacketed with a PVC or Fluoropolymer compound. The jacket thickness shall be 0.0200 inch minimum.

2.4 CABLE TRAYS: Cable trays shall conform to NEMA VE 1 and be the type and size indicated or as necessary to match the items being replaced.

2.5 CONDUIT AND FITTINGS: Conduit and fittings shall conform to UL 1, UL 3, UL 6, UL 514B, UL 651, UL 651A, and UL 797 as appropriate for the application, and be the type and size indicated or as necessary to match the items being replaced.

2.6 EQUIPMENT:

2.6.1 Acceptable Manufacturers: Contractor shall include manufacturer name and model number for equipment proposed. Manufacturers shall be of reputable brand quality. The Contractor will supply complete technical data specifications with submittals. The contractor will arrange for a product demonstration at the request of the COR and will provide ground freight to and from the site. The COR reserves the right to accept or refuse any equipment without condition.

2.6.2 General Requirements:

- Equipment shall be new and conform to ANSI, CSA and UL requirements.
- Take care during installation to prevent damage.
- Provide all labels as outlined above. Labels are to be of an engraved Lamicoid. Embossed labels are not acceptable.
- Connector plate finishes will be coordinated with the COR. Plastic plates will not be accepted. Plates must be appropriately labeled.
- All racks with surfaces exposed to public view will be finished in accordance with COR's color selection.

2.6.3 Digital Audio Auto-Mixer: 7 are required and they shall have the following characteristics:

- Have no less than 8 inputs selectable either mic or line level.
- No less than 4 outputs selectable either mic or line level.
- All inputs and outputs must have dynamics control (Equalizer, Compression).
- Acceptable manufacturer and model includes Mackie Industrial DX810.

2.6.4 CD/Cassette Deck: 7 are required and they shall have the following characteristics:

- Acceptable manufacturer and model includes Denon DN-T620.

2.6.5 VCR: 7 are required and they shall have the following characteristics:

- Must be able to playback VHS and S-VHS video tapes.
- Must be able to record.
- Must have a tuner to accept standard broadcast or cable television feeds.
- Must be able to be remote controlled.
- Acceptable manufacturer and model includes JVC SR-V10U.

2.6.6 DVD Player: 7 are required and they shall have the following characteristics:

- Must be able to be remote controlled.
- Acceptable manufacturer and model includes Phillips DVD175.

2.6.7 Wireless Microphone System: 7 are required and they shall have the following characteristics:

- Must be in the UHF range.

- Must include both body-pack and hand-held transmitter.
- Receiver must be rack-mountable and accept remote antenna feeds if necessary.
- Remote antennas will be installed at the contractors expense if deemed necessary.
- Acceptable manufacturers and models include Shure - UC124C/58 and WL184 SuperCardioid Lavaliere Microphone.

2.6.8 Assistive Listening System: 7 are required and they shall have the following characteristics:

- Install antenna system in accordance with manufacturer's instructions.
- Acceptable manufacturers and models include Gentner TX37A Plus receivers and Phonic Ear On wave System.

2.6.9 A/V Switcher: 7 are required and they shall have the following characteristics:

- Provides 3 composite video inputs and 3 RGB inputs.
- Accepts audio on each channel.
- Output is RGB plus audio.
- Acceptable manufacturer and model includes Extron System 75C.

2.6.10 A/V Switcher Controller: 7 are required and they shall have the following characteristics:

- Will select between sources.
- Will control playback devices.
- Adjust volume level.
- Control room lighting.
- Raise and Lower Screen.
- Acceptable manufacturer includes Crestron - CNMSX-AV used in conjunction with TP-3000L touch-panels; must provide Extron BB3000 back box to electrical contractor.

2.6.11 Video Projector: 7 are required and they shall have the following characteristics:

- Must be not less than 3,500 ANSI Lumens output.
- Must accept RGB input.
- Must have dual lamps (capable of operating in single lamp mode).
- Must be remote controllable.
- Must have a mechanical light shutter for blackout.
- Must include mounting hardware.
- Must include zoom lens (F1.3-1.8).
- Substitutions are not accepted for this item; must be Barco iQ-G300.

2.6.12 RGB Input Plates: 14 are required and they shall have the following characteristics:

- Two locations in each room.
- Must accept computer video and audio.

- Acceptable manufacturer and model includes Extron RGB460xi; must include 24V power supply (located in control room).

2.6.13 Loudspeakers: 107 are required and they shall have the following characteristics:

- Will mount into acoustical tiles in drop ceiling.
- Accept 70 Volt distributed feed.
- Acceptable manufacturer and model includes JBL Control 26T.

2.6.14 Audio Amplifiers: 7 are required and they shall have the following characteristics:

- Will provide 70 volt output.
- Acceptable manufacturer and model includes Crown - CH1.

2.6.15 Background Music and Paging System: Equipment shall have the following minimum characteristics:

- Switcher will select from multiple audio playback sources.
- Will provide outputs for 3 separate zones.
- Acceptable manufacturer and model includes Mackie Industrial - Sound Palette SP 2400 Bus linked to SP 1200 to provide three output zones.

2.6.16 CD-Tuner: 1 is required and it shall have the following minimum characteristics:

- Will provide independent outputs for both functions.
- Tuner will be AM/FM.
- Acceptable manufacturer and model includes Denon DN-H800.

2.6.17 Cassette Player: 1 is required and it shall have the following minimum characteristics:

- Dual well with auto reverse and relay play.
- Acceptable manufacturer and model includes Denon DN770R.

2.6.18 Building A/V Matrix Switcher: 1 is required and it shall have the following minimum characteristics:

- Will provide 8 inputs and outputs.
- Will be RGBHV plus audio format.
- Will be RS 232 controllable.
- Acceptable manufacturer and model includes Extron Crosspoint 88HVA.

2.6.19 Controller CPU: 8 are required and they shall have the following characteristics:

- Will be used to control AV and lighting.
- Acceptable manufacturer and model includes Crestron CNMSX-AV.

2.6.20 Controller CPU Remotes: 15 are required and they shall have the following characteristics:

- Will be located in each room per the drawings and control lighting and sound system audio levels.
- Acceptable manufacturer and models includes Crestron TPS3000L.

2.6.21 Equipment Racks: 8 (minimum) are required and they shall have the following characteristics:

- Shall be sufficient in size and number to accommodate all equipment.
- Will have sufficient extra room to ensure adequate ventilation to prevent overheating.
- All finishes must be unobtrusive.
- Must rollout and rotate to facilitate equipment maintenance and/or repair.
- Acceptable manufacturer and model includes Raxxess CPROTR-35.

2.6.22 Portable System (Add Alternate): The AV Contractor shall furnish one or more fully assembled portable system as an add alternate. Each portable system shall include the following components:

2.6.22.1 Rack Mounted Mixer: 1 is required and it shall have the following minimum characteristics:

- 16 mic/line inputs.
- Minimum of 3 mix busses.
- Stereo output.
- Acceptable manufacturer and model includes Mackie 1604 VLZ-PRO.

2.6.22.2 Stereo 31-Band Graphic Equalizer: 2 are required and they shall have the following characteristics:

- LED bar graph input level indicator.
- Level control.
- On board adjustable limiter.
- Acceptable manufacturer and model includes dbx 2231.

2.6.22.3 CD/Cassette Deck: 1 is required and it shall have the following minimum characteristics:

- Will provide independent output for each.
- Will provide a single out put for both, switch selectable from the front panel.
- Acceptable manufacturer and model includes DN-T620.

2.6.22.4 Effects Processor: 1 is required and it shall have the following minimum characteristics:

- Should operate stereo or dual mono.
- Must be able to store user created programs.
- Must have default factory settings.
- Acceptable manufacturer and model includes Lexicon MPX 500.

2.6.22.5 Audio Snake: 1 is required and it shall have the following minimum characteristics:

- Must provide 16 channels of inputs on XLR type connectors.
- Must provide at least 4 stage returns on XLR type connectors.
- Must be at least 100 feet long.
- Must provide a case or reel for transporting.
- Acceptable manufacturer and model includes Proco Roadmaster RM1604FBX-100.

2.6.22.6 Front of House Speakers: 2 are required and they shall have the following minimum characteristics:

- Minimum 15 inch two-way, bi-amplified cabinet.
- Must be active.
- Must be stand mountable.
- Acceptable manufacturer and model includes Mackie SA1521.

2.6.22.7 Monitor Speakers: 2 are required and they shall have the following minimum characteristics:

- Minimum 12 inch two-way, bi-amplified cabinet.
- Must be active.
- Must be stand mountable.
- Acceptable manufacturer and model includes Mackie SRM450.

2.6.22.8 Microphone Stands: 4 Atlas microphone stands with booms and 2 Atlas short microphone stands.

PART 3 EXECUTION

3.1 GENERAL: Install audio and visual systems as indicated on the plans and specified herein.

3.2 INSTALLATION: Install equipment in accordance with the equipment manufacturer's written installation instructions, approved shop drawings, and the requirements herein. Equipment mounted out-of-doors or subject to inclement conditions shall be weatherproofed. Installation also includes the following:

- Schedule all work with the COR.
- All AC Power circuits will be 120V, 3-conductor with isolated ground. Provide at least one spare outlet in each rack.
- Mount equipment in racks and fully test before delivery to the site.
- Provide adequate ventilation in each rack to prevent overheating of any equipment.
- Route wiring in rack to separate AC and control cables from audio and video cables.
- Take care to prevent electromagnetic and electrostatic hum. Do not cut off unused shields.
- Damaged cables, connectors or equipment will not be accepted.
- Execute all wiring in strict adherence to "standard broadcast practice".
- Provide an engraved label over each user operated control describing function or purpose of control. Embossed labels are not acceptable.

- Cables and wiring are to be labeled permanently hand written or self-laminating labels are not acceptable. Labels must be within two inches of the beginning and end of each run. Any cables runs that are spliced must be labeled according their leg of the run.
- Provide labels on equipment indicating wire or cable landed there.

3.3 WIRING: Wiring shall be installed in rigid conduit, intermediate metal conduit, cable trays, or electric metallic tubing as specified in SECTION 16050, ELECTRICAL. Wiring for microphone, grounding, line level, video, speaker and power cables shall be isolated from each other by physical isolation and metallic shielding. Shielding shall be terminated at only one end.

3.4 GROUNDING: All grounding practices shall comply with NFPA 70. The system shall utilize a multiple-point signal grounding scheme where conductive path connections are required between each piece of equipment and the reference ground point. An isolated ground bar for power shall be provided for the connection of the main system components. The ground bar shall be connected to the main service ground utilizing a No. 6 conductor.

3.5 ACCEPTANCE TESTING: Acceptance testing will include of the system and any other components deemed necessary. Contractor will provide two technicians familiar with the installation for the entire testing period (day and night) to assist in tests, adjustments and modifications. The Contractor will provide any and all tools necessary to make repairs, corrections, modifications, or adjustments. In the event the need for further adjustment or work becomes evident during testing, the Contractor will continue his work until the system is acceptable without addition to the contract price. Additionally, the Contractor will be responsible for any additional expenses incurred by the Government's consultant at the consultant’s standard rate at that time during any extension of the testing phase.

3.5.1 The Consultant will verify the proper operation of the equipment. Consultant will make any necessary "fine tuning" adjustments and record these in the system operation manuals. Inventory will be taken of all equipment per the contract.

3.5.2 Contractor will provide six hours of operations instruction to the Government's staff. Three hours will be conducted upon acceptance of the system and an additional three hours will be provided at the Government's request with in six months. The lead technicians for the system installation will be present at the first formal use of the system.

3.6 ADD ALTERNATE: One or more portable sound systems to support events such as musical acts will be provided as an Add Alternate. The system will be self-contained with reasonable ease-of-use features. The system will include a compact, rack-mounted mixer, and equalizers for tone and feedback control, to active monitors and to active front fill speakers. A selection of vocal and instrument microphones will be part of the system. The AV contractor will also provide direct input boxes. A single simple effects processor will be included. All of the equipment will be mounted in a Slant top rack equipped with casters to facilitate mobility. Locking drawers will be provided for storage and security. Equipment will include those items in paragraph 2.6.22 above.

DIVISION 16 - ELECTRICAL

SECTION 16780

COMMUNITY ANTENNA TELEVISION SYSTEM

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for installation of a community antenna television (CATV) system required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time the contract is awarded.

1.2.1 Electronic Industries Alliance (EIA-TIA) Standards:

170	Electrical Performance Standards - Monochrome Television Studio Facilities.
403-A	Precision Coaxial Connectors for CATV Application.

1.2.2 National Electrical Manufacturers Association (NEMA) Publication:

VE 1	Metal Cable Tray Systems.

1.2.3 National Fire Protection Association (NFPA) Publication:

70	National Electrical Code (NEC).

1.2.4 Underwriters Laboratory (UL) Publications:

1	Flexible Metal Conduit.
3	Flexible Nonmetallic Tubing for Electric Wiring.
5	Surface Metal Raceways and Fittings.
6	Rigid Metal Conduit.
50	Enclosures for Electrical Equipment.
83	Thermoplastic-Insulated Wires and Cables.
514A	Metallic Outlet Boxes.
514B	Fittings for Conduit and Outlet Boxes.
651	Schedule 40 and 80 Rigid PVC Conduit.
651A	Type EB and A Rigid PVC Conduit and HDPE Conduit.
797	Electrical Metallic Tubing.
1655	Community-Antenna Television Cables.

1.2.5 U.S. Department of Commerce Product Standard (PS):

PS 1 Construction and Industrial Plywood.

1.3 SUBMITTALS:

1.3.1 List of Materials: Submit a certified list of materials or manufacturer's descriptive literature for all major materials proposed for use in work under this section.

1.3.2 Installation, Operation, and Maintenance Instructions: Submit manufacturer's written installation, operation, and maintenance instructions.

1.3.3 Shop Drawings: Submit shop drawings for proposed installation of new components and replacement of existing system components. Submit shop drawings for proposed additions and changes to electrical systems.

1.3.4 As-Built Drawings: Submit as-built drawings for installation of new components and replacement of existing system components. Submit as-built drawings for additions and changes to electrical systems.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished under this section shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 CABLE AND WIRING:

2.2.1 General: Electrical cable shall conform to UL 83 and be the type and size indicated or as necessary to match the items being replaced.

2.2.2 CATV Cables: Shielded coaxial CATV cables shall conform to UL 1655 and be the type and size indicated or as necessary to match the items being replaced.

2.3 CABLE TRAYS: Cable trays shall conform to NEMA VE 1 and be the type and size indicated or as necessary to match the items being replaced.

2.4 CONDUIT AND FITTINGS: Conduit and fittings shall conform to UL 1, UL 3, UL 6, UL 514B, UL 651, UL 651A, and UL 797 as appropriate for the application, and be the type and size indicated or as necessary to match the items being replaced.

2.5 EQUIPMENT BACKBOARDS: Equipment mounting backboards shall be 3/4 inch thick B-C grade plywood and conform to PS 1. Fasten plywood backboards to framing and/or walls 24 inches o.c. around perimeter and in-the-field. Plywood backboards shall be the size indicated, and primed and painted with white or light colored paint.

2.6 EQUIPMENT RACKS:

2.6.1 Cable Guides: Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 19 or 23 inch equipment racks as indicated. 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 lockwashers.

2.6.2 Wall Mounted Open Frame: Wall mounted open frame equipment racks shall be steel or aluminum relay racks to mount equipment 19 or 23 inches wide as indicated with standoff brackets for wall mounting. Uprights shall be drilled

and tapped 12-24 in a 1/2 inch pattern. Standoff brackets shall be of sufficient length for a 6 inch clearance between rack and wall. Wall mounted open frame racks shall be hinged. AC outlets shall be provided as shown.

2.6.3 Wall Mounted Cabinets: Wall mounted cabinets shall conform to UL 50 and have boxes constructed of zinc-coated sheet steel with dimensions not less than those indicated. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum openings to the box interiors. Boxes shall be provided with 3/4 inch plywood backboard painted white or a light color. A duplex AC outlet shall be installed within the cabinet.

2.7 OUTLET BOXES AND FITTINGS: Boxes and fittings shall be galvanized steel or cast aluminum and conform to UL 514A and UL 514B, and be the type and size indicated or as necessary to match the items being replaced. Boxes for telecommunication outlets shall be 4-11/16 inches square by 2-1/8 inches deep with minimum 3/8 inch deep single or double gang plaster rings.

2.8 SURFACE METAL RACEWAYS AND FITTINGS: Surface metal raceways and fittings shall conform to UL 5, and be the type and size indicated or as necessary to match the items being replaced.

2.9 CATV SYSTEM:

2.9.1 Plenum Cable: Plenum cable shall conform to UL 1655 and rated CATVP per NFPA 70. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level.

2.9.2 Backbone and Riser Cable: Backbone and riser cable shall conform to UL 1655 and rated CATVR per NFPA 70. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level.

2.9.3 Horizontal Cable: Horizontal cable shall conform to UL 1655 and rated CATV per NFPA 70. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level.

2.9.4 Connecting Hardware:

2.9.4.1 Connectors: Connectors shall meet the requirements of EIA 403-A for coaxial cable connectors, as required for the service. Connectors for riser/backbone cable shall be Type N male. Connectors for station cable shall be BNC male. Station cable faceplates shall be provided and shall be [ivory] [_____] in color, [stainless steel], [double gang], with double-sided female BNC coupler. Mounting plates shall be provided for system furniture and shall match the furniture system in color.

2.9.4.2 Patch Panels: Patch panels shall be 19 or 23 inch rack mounted or wall mounted as indicated. Connectors shall be double-sided BNC female, feedthrough type. Connector mounting surface shall be constructed with a dielectric material. Connector mounting surface shall ground the connector shields. BNC feedthrough connectors shall meet the requirements of EIA 403-A for coaxial cable connectors. Panels shall [be labeled with alphanumeric x-y coordinates.

2.9.4.3 Patch Cords: Patch cords shall be cable assemblies consisting of flexible coaxial cable with BNC male connectors at each end. Cable shall meet the requirements of EIA 403-A for coaxial cable. Connectors shall meet the requirements of EIA 403-A for coaxial cable connectors.

PART 3 EXECUTION

3.1 GENERAL: Install a community antenna television (CATV) system as indicated on the plans and specified herein.

3.2 INSTALLATION: Install the CATV system components and appurtenances in accordance with EIA 170, the manufacturer's written installation instructions, the contractor's approved shop drawings, and the requirements herein. Necessary interconnections, services, and adjustments required for a complete and operable CATV system shall be provided. Conduits, raceways, wiring, and outlets shall be installed in accordance with NFPA 70 and SECTION 16050, ELECTRICAL. Components shall be labeled in accordance with EIA 606. Wiring, and terminal blocks and outlets shall be marked in accordance with EIA 606. Penetrations in fire-rated construction shall be firestopped in accordance with SECTION 07270, FIRESTOPPING. 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.

3.2.1 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 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 8 inches above ceilings by cable supports no greater than 60 inches 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 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. In raised floor areas, cable shall be installed after the flooring system has been installed. Cable 6 feet long shall be neatly coiled not less than 12 inches in diameter below each feed point in raised floor areas.

3.2.2 Riser and Backbone Cable: Vertical cable support intervals shall be in accordance with manufacturer's 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.

3.2.3 CATV Outlets:

3.2.3.1 Faceplates: As a minimum each jack shall be labeled as to its function and a unique number to identify cable link.

3.2.3.2 Cables: Shielded coaxial cables shall have a minimum of 6 inches of slack cable loosely coiled into the CATV outlet boxes. Minimum manufacturers bend radius for each type of cable shall not be exceeded.

3.2.3.3 Pull Cords: Nylon pull cords shall be installed in all conduits serving telecommunications outlets which do not initially have cable installed.

3.2.3.4 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.

3.2.3.5 Shielded Coaxial 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.

3.2.3.6 Equipment Racks: 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 rack 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.

3.2.3.7 Rack Mounted Equipment: Equipment to be rack mounted shall be securely fastened to racks by means of the manufacturer's recommended fasteners.

3.3 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.

3.3.1 CATV 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.

3.4 GROUNDING: Signal distribution system ground shall be installed in the CATV entrance facility and in each CATV closet in accordance with EIA 607 and SECTION 16050, ELECTRICAL. Equipment racks shall be connected to the electrical safety ground.

3.5 ADDITIONAL MATERIALS: Furnish the following additional materials required for facility startup.

3.5.1 10 of each type outlet.

3.5.2 10 of each type cover plate.

3.5.3 1 of each type terminal block for each CATV closet.

3.5.4 4 Patch cords of 10 feet for each CATV closet.

3.5.5 1 Set of any and all special tools required to establish a cross connect and to change and/or maintain a terminal block.

3.6 ADMINISTRATION AND LABELING:

3.6.1 Labels: All labels shall be in accordance with EIA 606.

3.6.2 Cable: All cables will be labeled using color labels on both ends with [encoded] identifiers per EIA 606.

3.6.3 Termination Hardware: All workstation outlets and patch panel connections will be labeled using color coded labels with [encoded] [unencoded] identifiers per EIA 606.

3.7 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.

3.7.1 CATV 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.